Fermi National Accelerator Laboratory

FERMILAB-TM-1919

Technology Transfer at DOE Dedicated Program Laboratories A Workshop

Edited by J. Venard and E. Schermerhorn

Fermi National Accelerator Laboratory
October 6, 1994

Operated by Universities Research Association Inc. under Contract No. DE-AC02-76CHO3000 with the United States Department of Energy

TABLE OF CONTENTS

Technology Transfer at DOE Dedicated Program Laboratories
A Workshop

FERMILAB-TM-1919

Section A.

Introduction and Explanation of Contents

Introduction and Explanation of Contents

The October 6, 1994 workshop on Technology Transfer at DOE Dedicated Program Laboratories held at Fermilab was intended to provide a forum to consider the issues associated with developing meaningful partnerships between industry and the four "single purpose" DOE laboratories - CEBAF, FNAL, PPPL and SLAC.

The Organizing Committee (see Attachment 2) made a conscious effort to seek attendees representing several levels within the Department and within the individual laboratories as well as from large and small industry. This was done to ensure that the workshop discussions benefited from all the constituencies affected by the technology transfer activities at these four laboratories. As can be seen from Attachment 3, the workshop participants did span several levels and all the targeted "stake holders."

(All Attachments are in **Section E.**)

The workshop received a welcome from John Peoples, Fermilab's Director, and Fred Bernthal, President of Universities Research Association, Inc. (URA). URA operates the Fermi National Accelerator Laboratory under a contract with the DOE.

Workshop Objectives

Fred Dylla, Technology Transfer Manager at CEBAF, opened the workshop. He charged the workshop participants with two Objectives and posed two Key Questions. His Workshop Introduction appears in **Section B**.

Presentations

As indicated in the agenda, a representative of each of the Dedicated Program laboratories gave an overview of the capabilities, technology transfer opportunities and the partnering activities currently underway at their site. Attachments 4-7 are the overheads from those presentations. Each of these presentations was supplemented with brief remarks from representatives of industry partner organizations.

A second set of presentations, reflected in Attachments 8-10, from representatives of three large, technology intensive companies set the stage for understanding the needs of such companies and their experiences, good and bad, to date in partnering with DOE laboratories.

Finally, the workshop participants heard three presentations by DOE representatives (see Attachments 11-13). Each of these officials represented a particular level or programmatic interest within the Department. Taken together, these three presentations provided a broad perspective on the goals, objectives, progress and successes of the DOE technology transfer activities.

Breakout Session Reports

Particpants attended one of three breakout sessions in the afternoon, designed to focus on particular aspects of the topic. The sessions (and chairpersons) were:

- Role of the Dedicated Labs in Major DOE Partnerships. (L. Meixler, PPPL)

- Industry Cultural Barriers to Dealing with Federal Labs. (A. MacLachlan, DuPont, ret.)

- Structural/Motivational Barriers to T^2 at Dedicated Program Labs (T. Nash, FNAL)

The breakout session results, as summarized by the chairperson for each, are presented in **Section C**.

Wrap-up for the Workshop

David Leith wrapped up the events of the day and summarized the presentions and discussions. His entire report is given in **Section D**.

Section B.

Workshop Introduction: Technology Transfer at the DOE Dedicated Program National Laboratories

H. F. Dylla

Workshop Introduction: Technology Transfer at the DOE Dedicated Program National Laboratories

Fermi National Laboratory
October 6, 1994
H. F. Dylla

We have three constituencies represented at this workshop: from the laboratories we have representatives from lab management and the lab technology transfer programs; from DOE we have representatives from the DOE Energy Research programs and technology transfer management, and we particularly welcome the focus of this workshop—our representatives from our industry partners. A goal of this workshop is to demonstrate to all three groups that all four Dedicated Program laboratories—FNAL, SLAC, PPPL and CEBAF—have a broad range of technologies of interest to industry. These four labs may be "dedicated" or "single program" by name, but in no way does this mean that their many technologies can be called single purpose.

Let me cite some examples:

- There is world-class operational and developmental technology on real time operating systems and high capacity data acquisition systems at all four labs.
- At the three accelerator laboratories there is accelerator technology which has been and will continue to be applied to advanced light sources, electron beam irradiation systems for curing and sterilization, and medical diagnosis and therapy.
- At PPPL there is obvious expertise in plasma physics, plasma-material interactions and plasma diagnostics that can be applied to plasma processing of materials.

In addition, all four of the labs have tremendous capabilities in a broad range of industrially vital engineering fields, including:

- magnet technology
- high power electronics
- radiation detectors across the spectrum
- cryogenics
- vacuum technology
- large mechanical structures.

These are unique capabilities, as are similar expertise and facilities at the DOE Multi-Program and Defense labs. Yet, there is a perception among our potential industrial clients that the Dedicated Program labs are less interesting and are of less value for partnering than the larger Multi-Program and Defense labs. We need to erase this perception. Therefore, an objective of this workshop should be to outline a plan that uniformly markets the value of DOE' s investment in the Dedicated Program and Multi-Program labs and presents the opportunities to industry for leveraging this investment for collaborative technology development.

Workshop Objective:

a) **Highlight the opportunities for technology transfer at the DOE Dedicated Program laboratories.**

(b) **Provide DOE with suggestions and recommendations for improving the Department's management and marketing of these opportunities.**

The second objective that I propose we consider at this workshop concerns mechanisms for working with industry. There is a strong willingness to work with industry at the Dedicated Program national labs, but we need a new operating model to optimize and strengthen this interaction. There are two operating models at present: (1) technology transfer activities can be supported from a tax on the dedicated program basic research funds provided to each laboratory, or (2) direct funding can be provided for technology transfer activities, such as the modest funding which just became available to the Dedicated Program labs this past February through Alan Claflin's program at DOE Headquarters (funds which were gratefully received and well spent, as you will hear later on this morning). But it must be said that neither support mechanism can be put on a growth curve that will allow the full benefits of collaboration with industry to accrue to all parties represented here today: to DOE, the labs or our industry partners.

Program taxes are never a popular or an effective mechanism of funding any activity. The tax-supported program does not win the moral support of the taxed program and can never grow to be large compared to the program budget. Our main constituency at the Dedicated Program labs—the basic scientists who invented and nurtured the basic research programs which are the reason for the labs' existence—would view a tax-supported technology transfer program as further erosion for support of basic science.

What we need in the post cold war/post SSC era (and I see both as threshold events defining the need for new funding paradigms for science and technology funding) is a home for technology transfer in DOE and specific funding appropriated for this important mission of the Department. If we consider the formation of a Program Office and program-dedicated funding for technology transfer within DOE, what are good models to use for the operational basis of this Program? I would like to consider two examples of model programs that may stimulate further discussion at this workshop:

First, the NIST Advanced Technology Program
The jury is still out on this 4 year-old program with respect to its impact on economic development, which should be the primary metric of any technology transfer program. However, industry feedback to date is positive, primarily based on NIST's even-handed management and very effective promotion of the program. Reaction from the rank-and-file scientists and engineers at the NIST laboratories was initially neutral or negative because of the perception that the ATP would not have any positive influence on NIST's flat or declining budgets for its internal science programs. But as the ATP has grown from its initial funding of $10M to its 1995 allocation of nearly $500M, both the internal perceptions of the value and the actual value of the program to NIST have changed accordingly.

Let us examine some specifics of the ATP that are worth our consideration as we discuss this as a model program:

- the program is industry led; single companies or consortia containing at least one for profit business must take the lead in a proposal,
- dedicated funds are appropriated for the program; these funds must be matched by industry, and
- there are feedback mechanisms to encourage the involvement of the NIST internal science and technology programs: NIST staff participate in proposal

reviews prior to ATP awards and can participate in ATP R&D programs after awards through a 10% kickback of ATP funds to NIST internal programs.

The ATP has gotten a lot of good press lately, and more importantly has attracted sufficient Administration and Congressional interest to put it on track for $1B of new money in less than 5 years. This leads naturally to a question about DOE, which has larger and more varied science and technology programs than the Department of Commerce. Both agencies began significant new efforts in technology transfer at the start of this decade. Why did we miss the boat? Perhaps it was because of a perception on the part of Congress, the Administration and industry that NIST has established better working relationships with industry. If this perception is valid, then workshops such as this one—with proper follow-up—can help erase it.

I would like us to consider a second model for technology transfer interactions: LETI CEA Advanced Technologies—the French National Laboratory for technology development and transfer to industry. LETI's charter is to develop new commercially attractive technologies for industry, using the French National Laboratory and university systems as its bank vault of ideas. LETI currently obtains 95% of its funding from industry.

One of LETI's high profile accomplishments is that it has taken the current lead in the development of two dimensional field emission arrays for flat panel displays. This technology promises a brighter, lower power, and lower cost alternative to active matrix LCD displays. The $6B flat panel display market is projected to grow to $40B by the end of the decade and is currently dominated by Japanese manufacturers.

Can the LETI model work in the DOE National Laboratory environment? It would take quite a change in culture.

There are other operating models for technology transfer that are worth considering—such as the recent formation of a commercial arm to the Canadian Chalk River Atomic Energy Labs-AECL Ltd. and the US-ARPA led consortium SEMATECH. So as a workshop objective I propose that we initiate the following study:

Key Questions: Which technology transfer and development partnerships are working and why? What are appropriate operational models for technology transfer in the DOE laboratories?

In consideration of this objective we may come back to the NIST-ATP. The focus of ATP projects is short term (typically 3-5 years) and relatively modest funding packages (a few $M per project). There are technology development needs in this country that require considerably larger funding blocks with longer term commitments, such as the demands for environmental technologies including:

- environmentally friendly manufacturing processes (light or plasma based),
- advanced central station power generation and transmission equipment, and
- next generation transportation vehicles.

DOE has much experience with the management of large, billion dollar budget, decade long development projects. The successful operations of the huge machines at all four of the DOE labs represented at this conference are examples of government-university-industry partnerships that we can be proud of. How can we put the best of what we learned from this experience for basic science at work in the applied sciences for the benefit of US industry? Consideration of this question leads to my final suggestion for an objective for this workshop:

Key Question: Consider the need and operational basis for a program office and dedicated funding for technology transfer and development within DOE.

For discussion items I propose that this Program Office would:

- coordinate and fund the existing and any new DOE major technology transfer partnerships such as USCAR and AMTEX,
- ensure that these partnerships are industry driven,
- offer incentives to seek out the involvement of scientists and engineers from DOE's basic science research programs,
- provide healthy funding for seed projects at all of DOE's major labs for technical assistance projects, small CRADAs and personnel exchanges,
- remove the funding asymmetries that presently exist in CRADAs and personnel exchanges (that is, money can now flow only in one direction—which is not a good property of a partnership), and
- remove the excessive bureaucracy that burdens the DOE work-for-others programs.

My colleagues who have organized the discussion sessions this afternoon have provided additional questions for us to ponder as we work together to further define this new and important mission for the DOE laboratories.

H. F. Dylla
Technology Transfer Manager
Continuous Electron Beam Accelerator Facility
Phone: (804) 249-7450
Fax: (804) 249-7658
Email: Dylla@CEBAF.gov

Section C.

Breakout Reports

Breakout 1:

- Role of the Dedicated Labs in Major DOE Partnerships
  Chair: Lew Meixler, PPPL

1. Most attendees were not familiar with the workings of a major DOE Partnership so L. Meixler reviewed the structure of the AMTEX partnership. Of particular interest was the discussion of how the projects were selected, how they were administered, and how the funding flowed. Similarly, Jim Anderson discussed the Partnership for a New Generation Vehicle (PNGV) which grew out of USCAR.

Discussion of these and other major DOE partnerships focused on the difficulties experienced by the dedicated program laboratories, with their limited staff and resources, getting access to the somewhat complicated organization of a major DOE partnership in order to participate.

Specific problems particular to the single program laboratories in identifying and responding to major partnership, as well as opportunities in general, that were discussed were:

- Lack of resources to publicize capabilities, and to respond to opportunities. All of the dedicated program laboratories have very small Offices of Technology Transfer (generally one or at most two people), and those offices are still required to provide all the functions of the larger, better staffed Technology Transfer offices at the multiprogram and DP laboratories. The amount of time and effort devoted to meetings, "process" and reporting severely limits the amount of time and effort available for real technology transfer progress.

- The perception on the part of DOE, and industry, that the multiprogram Laboratories have broader scope and depth in relevant technology areas - consequently more support goes to the multiprogram laboratories.

- The need for a mechanism to identify and catalog the single program laboratorys' unique capabilities and a mechanism to keep that information current.

- Availability of scarce laboratory resources, especially the fact that the most appropriate researchers are usually the ones most likely not to have time available for technology transfer initiatives.

- The conflict in between devoting laboratory resources to the main mission vs. the technology transfer mission.

- Recent downsizings at the dedicated program laboratories that have exacerbated scarcity of personnel resources.

The breakout session participants discussed the idea of a DOE-wide searchable database where industry or other labs could search on Key Words to find the DOE laboratory with the right technology for a particular application.

The discussions also identified the need for a cultural change in the laboratories to promote involvement in technology transfer activities, and the need for a top down application of mechanisms to effect a cultural change, such as including technology transfer initiatives in performance reviews, awards, other forms of recognition, etc.

The participants suggested that DOE could play a role in addressing some of these problem areas by:

a) Providing a point of entry in the single program laboratories, as well as the multiprogram laboratories, for ease of industry access. DOE could maintain a central database, provide access with an 800 number, use on-line computer access, etc.

b) Putting together teams to address specific industry concerns - both the dedicated program and multiprogram laboratories should be involved and should given increased resources to participate in such teams.

c) Helping change the culture in the laboratories towards technology transfer activities with an increase in the number and variety of reward mechanisms; e.g., bonuses, plaques, dinners, feature articles, resources etc.

Breakout 2:

- Industry Cultural Barriers to Dealing with Federal Labs
  Chair: Alex MacLachlan, DuPont (ret.)

  Among the cultural barriers discussed were:

1. Inertia within companies toward working with the national laboratories can be overcome, at least to some degree, by the laboratories doing a better job of communicating success stories.

2. Companies find it more difficult, at least initially, to manage external projects.

3. Companies find it hard to choose among the many opportunities to partner with the laboratories and the universities.

Breakout 3:

- Structural/Motivational Barriers to T^2 at Dedicated Program Labs,
  Chair: Tom Nash, FNAL

The dedicated programs and industry would both benefit greatly from close partnerships. Among the structural/motivational barriers discussed were:

1. The perception by industry that expertise at the dedicated program laboratories is too far out in front of practical applications or too specialized to have industrial uses.

2. A perception by companies that the dedicated program laboratories may not be competent to project market needs and business uses for their technologies.

3. A disconnect between the private sector's sense of urgency to reach the market and the perception of the more leisurely pace of laboratory investigations.

The breakout session participants felt that technology focused industry advisory boards can be helpful in overcoming the above.

4. The difficulties faced by the dedicated program laboratories in attempting to balance the demands of external, two-way technology transfer relationships against internal, research-driven immediate demands. A major barrier is the perception of the laboratories' scientific user communities that any diversion of "their" programmatic funds is intolerable, particularly in an era of declining budgets.

The participants urged DOE to address the need to provide for continuity in WFO and/or CRADA funding to the dedicated program laboratories so that the required FTEs to satisfy both the above demands may be met. Both demands require talented, dedicated staff.

5. Artificial and cumbersome partitioning of the several formal technology transfer mechanisms. Most partnerships could benefit from effective mixing of the procurement, WFO and CRADA mechanisms. This is very difficult or impossible at present.

The breakout session recommended that the implications of easing the apparent requirements for strict separation amongst Procurement actions, Work for Others, and CRADAs be reexamined to determine how to use each to amplify the benefits of the others.

6. The reward structure for scientific staff at the dedicated program laboratories provides no motivation for researchers to broaden their focus to encompass industrial collaboration.

Participants suggested that additional external funding for scientific activities could be a powerful motivator for researchers.

The dedicated program laboratories need non program-specific funding as a sweetener to motivate greater interest in forming partnerships with the private sector. They are presently not on the primary client list for funding by technology transfer and technology oriented programs. This is a shame since, dollar-for-dollar, they have at least as broad and deep a technology mix as the multiprogram labs and their programs would benefit from effective partnerships.

Section D.

Wrap-up Talk for Technology Transfer at DOE Dedicated-Program Labs

D. W. G. S. Leith

Wrap-up Talk for Technology Transfer at DOE Dedicated-Program Labs

David W. G. S. Leith
SLAC, Stanford University

This is not an easy meeting to summarize in real time after a full day's session but the meeting has been an excellent opportunity to have industry, DOE, and laboratory staff talk together about the opportunities that exist for technology transfer programs at the program-dedicated labs. The labs have reported on their programs to effectively apply their core competencies to DOE's tech transfer activities. There are clearly changed attitudes -- labs are still careful stewards of their roles to maintain leadership internationally in science and engineering as per the visionary statement from Clinton and Gore -- but they also recognize the necessity and even the obligation to contribute to the tech transfer process, or as our friends in Europe more directly say, "contribute to the 'wealth generation' process for the nation."

We were introduced to a spectacular set of large-scale facilities at the DOE single-purpose labs and an impressive set of core competencies representing skills in fusion, cryogenics, accelerator technology, high-powered radio frequency and microwave sources, power electronics, fast electronics, computing and networking, and sophisticated mechanical engineering capabilities.

As Tom Nash had worked hard to set up this meeting, I wondered about the likelihood of success. However, the attendance of senior people from industry and the people who will have to carry the banner for this program within DOE in Washington -- (Alex MacLachlan and David Cheney) -- and from the labs makes it very likely to have been an effective, useful meeting that does not go into a "bureaucratic black hole" but will indeed have consequences, and will change the way we do business. That is something to celebrate.

I liked Fred Dylla's challenge in his introductory task this morning when he asked, "what is the appropriate model for DOE to actually make the Tech Transfer process really work?" This is a tough issue. The science programs are underfunded for effective utilization of the expensive capital investment that they represent. If the DOE funding of the Tech Transfer program at its full potential is actually to come out of current program funds, then there will be clear problems. Some creative discussion on how to maximize the capability of the DOE program-dedicated labs to fully contribute to the Tech Transfer enterprise is necessary. The example of the French situation quoted by Dylla is an extremely interesting one and we in the labs, and at DOE, need to think of other appropriate structures that would work for our case.

The pulling back of U.S. industry from very long-range research and development and the fact that this is the particular part of the jungle that the DOE single-purpose labs live in, should make for quite interesting opportunities. Many of the industry representatives at this meeting today see this opportunity clearly. However, the labs are all hanging on by their fingernails in terms of carrying out their mission, which is to do first-rate fundamental science and keep the nation in a leadership role in these areas. For example, at SLAC we are down 30 percent in purchasing power compared with our 1990 budget, but through reorganization and downsizing and making hard choices among very good science projects, the lab is still operating at the same level of shifts as we did in 1990. There is not much slack left, not much belt-tightening to be done at this time without giving up some of the world-class science that they were created to do. How can the need for long-range research and the opportunities that the DOE labs offer be married?

We heard interesting presentations from Ann-Marie Zerega and Cherri Langenfeld from DOE on cutting down response time, reducing bureaucracy, and generally improving DOE's response to these technology transfer opportunities. We heard from both industry and labs that proprietary research and intellectual property rights issues are serious questions. There are problems here but ones that can be solved and indeed are being solved.

As industry looks at the DOE labs, it sees too many options, too many opportunities, too many customers. Here industry could effectively follow the example of DuPont and define a single point of contact between large corporations and the DOE enterprise. This could also be part of the answer to Fred Dylla's question on the best model for DOE's organization of tech transfer. Perhaps the new MacLachlan-Cheney team could regard this as their problem. Industry in general felt that things go much better the second time through, and even better the third time. This sounds like another agenda item for the new DOE Tech Transfer team exploring how to make the collaborations between labs, DOE, and industry go more easily.

I would like to interject a thought here about "virtual laboratories." We talk a lot about the information super highway and the connectivity offered by computers and their associated networks. This is at the heart of the idea of the "virtual laboratory." We mostly talk about it in terms of not creating new national laboratories -- but I would suggest that this concept has a newer target in the Laboratory Tech Transfer Program for DOE. Here we have a chance to have scientists in industry work with appropriate teams of scientists in DOE labs, perhaps in several DOE national labs, and share their intellect and tools to solve common problems. I think that some thought as to how to implement such a "virtual lab" environment for a CRADA project could have a major impact on the Technology Transfer process and would improve DOE's standing with our potential industrial partners

Now let me move on to summarizing the three afternoon breakout sessions. First on the question of "The Role of the Dedicated Labs in Major DOE Partnerships" led by Lew Meixler. Here the main issues that surfaced were:

1. It would be useful to identify resources to publicize the lab's capabilities -- *the new DOE Tech Transfer office can perhaps help in this.*

2. The perception that the multi-program labs at DOE have more to offer. *In terms of one stop shopping, this is perhaps true -- but I do not believe in specific areas of competence that the single-purpose labs have any less capability or are less desirable partners. This is an area that we will need to work hard with the new MacLachlan-Cheney team.*

3. It would be useful to create data bases on capabilities and competencies at the program-dedicated labs in order that industry may identify the opportunities of interest to them. *We should do this.*

4. Industry senses a conflict at the program-dedicated labs. *There is a real opportunity in terms of facilities, intellect, and core competence. But there is a tremendous squeeze on these laboratories, already underfunded, to carry out their basic science mission. This is just a straight-forward conflict and not to realize it and confront it is a mistake.*

5. Finally, it would be useful if DOE could provide a single doorway or a single point of entry into the DOE single-purpose lab context. *Here again the MacLachlan-Cheney team can help and perhaps it can be dealt with in thinking through the organization for DOE tech transfer organizations in the spirit of Fred Dylla's challenge.*

The second breakout session entitled "Industry Cultural Barriers to Dealing with Federal Labs" was chaired by Alex MacLachlan. This group identified five issues, as follows:

1. To assert that the laboratory-industry collaboration is working, is effective -- but needs help. An exchange of people between labs and industry is an effective part of lab-industry collaboration. *The few CRADAs and joint projects that are in place are working effectively but the full potential that the labs represent to industry is far from being achieved and here the new tech transfer team can perhaps help in that.*

2. The collaboration with single-purpose labs is valued by industry -- but industry is interested in selective partners and is anxious to leverage industry involvement. *Here we need some help from DOE.*

3. Encourage analysis of each of the labs of their core competencies and work harder on sharing this core competency list with industry, especially small industry. *This speaks to trying to form a database DOE-wide and having some Internet activity. It would allow industry shoppers to identify the best customers.*

4. The labs and DOE both need to understand the needs and interests of their customers and understand the difference between big and small customers. *There was general recognition that geography is important, that labs should focus not exclusively but mainly on working with neighbors. The idea of "virtual laboratories" with computer interconnects may change this but*

certainly the one-on-one interactions that come from a neighboring geographical connection are important.

5. Finally, there was an emphasis on the importance of seed money for new projects and encouragement to DOE to think about this possibility. *This would be nice!*

The final breakout session was entitled "Structural/Motivational Barriers to Tech Transfer at Program-Dedicated Labs" chaired by Tom Nash.

1. Tom's first point was a very important issue on the rules for Procurements, Work For Others, and CRADAs -- all three of these areas are important aspects of DOE activities and their requirements and regulations for all three are not at all consistent *We need some DOE help in straightening out the contradictions in these areas.*

2. Recognition by both labs and industry on the tension between the labs' obligations to their fundamental science programs and to full participation in the tech transfer process. *Money could help this problem -- but money is tight.*

3. The suggestion was made that the labs might benefit individually or collectively within DOE, with an industry advisory board trying to identify the important technologies in each lab and make marriages between industry and those labs. *This should receive more attention at the labs and at DOE!*

While clearly in the few minutes between the closing of each session and bringing this meeting to an end I have not been able to do justice to all of the ideas that surfaced during the day and especially during the afternoon's discussion sessions, however, clearly it has been a positive interaction.

We should not let the list of things that need to be fixed dull the sparkle of the successes of the Laboratory Technology Transfer Program which brings labs and industry together to do better computing, to provide the laser facilities that industry needs to develop better high-technology products, or to work to understand how to limit the spread of AIDS. Collaboration on a very broad front of activities. The list of joint projects currently being attacked is very impressive. We should see -- we will see -- an impact in the market place and on the bottom line.

The cooperation of U.S. industry, large and small, with the opportunities presented at the DOE program-dedicated laboratories is such a natural "WIN-WIN" situation that we *all* have to work harder to make it work better.

I welcome in the new technology transfer team at DOE, Alex MacLachlan and David Cheney, and wish them well in their tasks.

Section E.

Presentation Attachments

Attachment 1

AGENDA

Technology Transfer at DOE Dedicated Program Laboratories
Fermi National Accelerator Laboratory
October 6, 1994

TECHNOLOGY TRANSFER AT DOE DEDICATED PROGRAM LABORATORIES

Fermi National Accelerator Laboratory

1 West Conference Room
8:15 am - 5:30 pm

October 6, 1994

8:00	Registration Desk Open - 2nd Floor South cross-over	
8:15	Welcome	John Peoples, Fermilab, Director Fred Bernthal, URA, Inc., President
8:30	Workshop Objectives	Fred Dylla, CEBAF
8:45	Extraordinary Opportunities at the Dedicated Program Labs	Chair - D. Nelson

CEBAF	Fred Dylla with Michael Kelley (DuPont)
FNAL	Tom Nash with Steve Wallach (Convex) & Ed Jedlicka (IBM)
PPPL	Lew Meixler
SLAC	David Leith with Stephen Laderman (Hewlett Packard)

10:45	Industry Perspective on Their Needs in Working with Dedicated Program Labs	Chair - A. MacLachlan

DuPont	Randy Guschl
Ford Motor Co.	Jim Anderson
Motorola	Charles Shanley

11:30	Break	
11:45	Background (*20 min + 5 min Q&A each*)	Chair - T. Nash
	The View from DOE-HQ	David Cheney, DOE, Consultant, Office of the Under Secretary
	ER-LTT Program	Anne Marie Zerega, DOE, Laboratory Management Div., Office of Energy Research
	The Perspective from DOE-CH	Cherri Langenfeld, DOE, Manager, Chicago Operations

1:00	Working Lunch in Breakout Session Rooms	
1:00	Breakout Sessions:	

- Role of the Dedicated Labs in Major DOE Partnerships
  Lew Meixler (PPPL), Chair
  Snake Pit
- Industry Cultural Barriers to Dealing with Federal Labs
  Alex MacLachlan (DuPont, ret.) Chair
  Comitium
- Structural/Motivation Barriers to T^2 at Dedicated Program Labs
  Tom Nash (FNAL), Chair
  3rd Floor Theory

Breakout session charges prepared by the chairs, are attached.

3:30	Break	
3:45	Breakout Session Reports - 1 West	
4:15	Discussion	
5:15	Wrap-up	David Leith, SLAC
5:30	Adjourn	

12/8/94

Industry Cultural Barriers to Dealing with Federal Labs

Chairman: A. MacLachlan

Comitium

Questions to address:

1. What processes does your company use to develop partnerships with national labs? What's working and what's not working?
2. How is it doing? Is this activity broadly valued within your company? If it is, why so? If it isn't, why not?
3. What's being done to improve?
4. What might the labs or DOE do to assist (beyond current actions which include patent assignments, faster CRADAs, etc.)?
5. Where do you think the special purpose labs contribute best? Why?

Role of the Dedicated Labs in Major DOE Partnerships

Chairman: L. Meixler

Snake Pit

Questions to address:

1. Do the program dedicated labs have a role in the major partnerships?
2. Which labs have major partnership roles?
3. Experiences of those labs to date.
4. What are the capabilities that the PDLs can offer to the major partnerships? Nature of the capabilities - broad capabilities vs. specialized areas of capabilities.
5. Are there barriers unique to the PDLs in participating in major partnerships? What can be done to overcome them?

Structural / Motivation Barriers to TT at Dedicated Program Dedicated Labs

Chairman: T. Nash

3rd Floor Theory

Questions to address:

1. What is the major impediment to TT at each lab? Are there other issues?
2. How does tech transfer integrate / not integrate into the mainline program at each lab?
3. What is each lab doing to balance its program and tech transfer?
4. How can DOE help? How can industrial partners help? (Other than special funding.)

Attachment 2

Workshop Organizing Committee

Technology Transfer at DOE Dedicated Program Laboratories
Fermi National Accelerator Laboratory
October 6, 1994

Workshop

Technology Transfer at DOE Dedicated Program Laboratories

Organizing Committee

Alan B. Claflin
Director, Laboratory Management Division
Office of Laboratory Management
LM-10 3F-077/FORS
U.S. Department of Energy
Washington, DC 20585
202 586 9740 voice 202 586 3119 FAX

Anne Marie Zerega
Office of Laboratory Management
LM-10 3F-077/FORS
U.S. Department of Energy
Washington, DC 20585
202 586 3560 voice 202 586 3119 FAX

Dr. Alexander MacLachlan
Senior Vice President (ret.)
DuPont Research and Development
Member of Fermilab Board of Overseers
& Chairman of the Board of Overseers *ad hoc* Committee on Tech Transfer
301 Centennial Circle
Wilmington, DE 19807
302 427 9370 (voice and FAX)

Dr. Dale Meade
Deputy Director,
Princeton Plasma Physics Lab
Forrestal Campus, P.O. Box 451
Princeton, NJ 08543
609 243 3301 voice 609 243 2749 FAX

Dr. Frederick Dylla
Technology Transfer Manager
CEBAF
12000 Jefferson Avenue
Newport News, VA 23606
804 249 7450 voice 804 249 7658 FAX

Dr. David Leith
Director of Research
Stanford Linear Accelerator Center
P.O. Box 4349
Stanford, CA 94309
415 926 2663 voice 415 926 4500 FAX

Dr. Irving Wladawsky-Berger
General Manager, POWER Parallel Systems
IBM Corporation
Member of Fermilab Board of Overseers
and the Board of Overseers *ad hoc* Committee on Tech Transfer
914 766 2300 voice 914 766 2660 FAX

Dr. Thomas Nash (Workshop Chairman)
Associate Director for Scientific Technology
and Laboratory Information
Fermilab
P.O. Box 500
Batavia, IL 60510
708 840 3203 voice 708 840 2939 FAX
(Luann O'Boyle, Administrative Assistant)

Mr. John Venard
Head, Office of Research & Technology Application
Fermilab
P.O. Box 500
Batavia, IL 60510
708 840 3333 voice 708 840 8752 FAX

Dr. Frank Rinaldo
Assistant Director,
Fermilab
P.O. Box 500
Batavia, IL 60510
708 840 8449 voice 708 840 2939 FAX

Dr. Elizabeth Schermerhorn
consultant for Computing Division,
Fermilab
P.O. Box 500
Batavia, IL 60510
607 844 3481 voice 607 844 3665 FAX

Dr. Ezra Heitowit
Vice President,
Universities Research Association, Inc.
1111 19th Street, N.W., Suite 400
Washington, DC 20036
202 293 1382 voice 202 293 5012 FAX

Attachment 3

Workshop
Speakers, Participants, and Attendees

Technology Transfer at DOE Dedicated Program Laboratories
Fermi National Accelerator Laboratory
October 6, 1994

SPEAKERS, PARTICIPANTS, AND ATTENDEES
(not already listed as part of the organizing committee)

David Cheney
Consultant
Office of the Under Secretary
S -3/7A219
U.S. Department of Energy
Washington, DC 20585
202 586 6479 voice 202 586 6828

Dr. John Peoples
Director
Fermilab
P.O. Box 500
Batavia, IL 60510
708 840 3211 voice 708 840 2939 FAX

Dr. Fred Bernthal
President, URA
1111 19th Street, N.W., Suite 400
Washington, DC 20036
202 293 1382 voice 202 293 5012 FAX

David Nelson
Office of Energy Research
ER-1
U. S. Department of Energy
Washington, DC 20585
202 586 0095 voice 202 586 1009 FAX

Gordon Charlton
Office of Energy Research
ER-223 H-301/GTN
U.S. Department of Energy
Washington, DC 20585
301 903 4801 voice 301 903 3833 FAX

John R. Erskine
Office of Nuclear Physics
ER-23 G315/GTN
U.S. Department of Energy
Washington, DC 20585
301 903 3613 voice

Cherri J. Langenfeld
Manager,
Chicago Operations Office
U.S. Department of Energy
9800 South Cass Avenue
Argonne, IL 60439
708 252 2110 voice 708 252 2206 FAX

David T. Goldman
Deputy Manager,
Chicago Operations Office
U.S. Department of Energy
9800 South Cass Avenue
Argonne, IL 60439
708 252 2700 voice

Larry J. Vann, Director
Office of Planning, Communications and Diversity
Chicago Operations Office
U.S. Department of Energy
9800 South Cass Avenue
Argonne, IL 60439

Charles E. Pietri
Institutional Management Branch,
Chicago Operations Office
U.S. Department of Energy
9800 South Cass Avenue
Argonne, IL 60439
708 252 2449

James Miller
Deputy Manager,
Batavia Area Office
U.S. Department of Energy
708 840 3281 7098 840 3285 FAX

Roberto Guerrero
Batavia Area Office
U.S. Department of Energy
708 840 3281 7098 840 3285 FAX

Dr. Steve Eckstrand
Office of Fusion Energy
ER-55 G-246/GTN
U. S. Department of Energy
Washington, DC 20585
301 903 5546 voice 301 903 4716 FAX

Philip Debenham
Advanced Technology Research & Development Branch
ER-224
U. S. Department of Energy
Washington, DC 20585
301 903 5228 voice 301 903 2597 FAX

Dr. William Oosterhuis
Chief, Solid State Physics & Materials Chemical Branch
ER-132
U. S. Department of Energy
Washington, DC 20585
301 903 3426 voice 301 903 9513 FAX

Dr. Jim Anderson
Advisor, Cooperative Technology Programs
Ford Research Laboratory, MD 3083
Ford Motor company
P.O. Box 2053
Dearborn, MI 48121-2053
313 594 1187 voice 313 594 2923 FAX

Dr. Maurice Glicksman
Chairman of the Fermilab Board of Overseers
Professor of Engineering and Physics
Box D
Brown University
Providence, RI 02912
401 863-1409 voice 401 863-1157 FAX

Dr. George Kalbfleisch
Department of Physics and Astronomy
University of Oklahoma
440 W. Brooks, Room 131
Norman, OK 73019
405 325 3961 voice 405 325 7557 FAX

Dr. Percy Pierre
VP of Research and Graduate Studies
Michigan State University
226 Administration Building
East Lansing, MI 48824

Lew Meixler
Princeton Plasma Physics Lab
Forrestal Campus, P.O. Box 451
Princeton, NJ 08543
609 243 3009 voice 609 243 2800 FAX

Dr. Randy Guschl
Director of Corporate Technology Transfer
DuPont Experimental Station
B-326, room 220
Wilmington, DE 19880-0326
302 695 3654 voice 302 695 9840 FAX

Mr. Richard J. Lusk
Procurement Representative
CEBAF/SURA
12000 Jefferson Avenue
Newport News, VA 23606
804 249-7602 voice 804 249-7398

Mr. Yehuda Arie
David Sarnoff Research Center
Subsidiary of Stanford Research International
CN 5300
Princeton, NJ 08543-5300
609 734 2612 voice 609 734 2035 FAX

Dennis Mroz
Account Manager,
Cray Research, Inc.
Suite 302
1301 West 22nd Street
Oak Brook, IL 60521
708 572 8535 voice 708 572 8563 FAX

Greg Urban
President
Omnibyte Corporation
245 W. Roosevelt Road
West Chicago, IL 60521
708 231 6880 voice 708 231 7042 FAX

Steve Wallach
Vice President for Technology
Convex Computer Corporation
3000 Waterview Parkway
P. O. Box 83351
Richardson, TX 75083-3851
214 497 4000 voice 214 497 3331 FAX

Dr. Arnold Kelly
Charged Injection Corporation
Princeton Corporate Plaza
9 Deer Park Drive
Monmouth Junction, MJ 08852
908 274 1470 voice 908274 1454 FAX

Ms. Sharon E. Stasko
President, Vertere dbaATSCAN
26 Valley Road
Middletown, RI 02840
401 847 2790 voice 401 847 7575 FAX

Dr. Michael J. Kelley
Central Science and Engineering Laboratories
Experimental Station
E. I. du Pont de Nemours & Co., Inc.
P.O. Box 80304
Wilmington, DE 19880-0304
302 695 3829 voice 302 695 2504 FAX

Mr. Jim Simpson
Administrator
SLAC
MS 2 A&E Bldg. 41 Room 203
2575 Sand Hill Road
Menlo Park, CA 94025
415 926 2213 voice 415 926 4999 FAX

Stephen Laderman
Hewlett Packard Co.
P.O. Box 100350
Mail Stop 26 L
Palo Alto, CA 94303-0867
415 857 5072 voice 415 857 5308 FAX

Catherine Anderson
Staff Associate, Communications
Universities Research Association, Inc.
1111 19th Street, N.W., Suite 400
Washington, DC 20036
202 293 1382 voice 202 293 5012 FAX

William Schmidt
Corporate Counsel
Universities Research Association, Inc.
1111 19th Street, N.W., Suite 400
Washington, DC 20036
202 293 1382 voice 202 293 5012 FAX

Gail Young
Treasurer
Universities Research Association, Inc.
1111 19th Street, N.W., Suite 400
Washington, DC 20036
202 293 1382 voice 202 293 5012 FAX

Charles W. Shanley, Ph.D.
Director of Techology Planning
Motorola Corporate Offices
1303 E. Algonqui Road
Schaumburg, IL 60196
708 538 2438 voice 708 576 5292 FAX

Harold Jaffe
Director,
Office of International Research and Development Policy
PO-70 IE-218/FORS
U. S. Department of Energy
Washington, DC 20585
301 903 2942 VOICE 301 903 5079 FAX

Ben Cocogliato
Sr. Regional Sales Manager
Chicago Precast Products Company
P.O. Box 69
Naperville, IL 60566-0069
708 961 6600 voice 708 961 5426 FAX

Dr. Joel Butler
Head, Computing Division
Fermilab
PO Box 500; MS 120
Batavia, IL 60510
708 840 3148 voice 708 840 2783 FAX

Dr. Irwin Gaines
Associate Division Head, Computing
(CPPM)
PO Box 500; MS 127
Batavia, IL 60510
708 840 4022 voice 708 840 2783 FAX

Judy Jackson
Fermilab
PO Box 500; MS 105
Batavia, IL 60510
708 840 4112 voice 708 840 2939 FAX

Dr. Hans Jostlein
Fermilab
PO Box 500; MS 122
Batavia, IL 60510
708 840 4546 voice 708 840 3867 FAX

Dr. Paul Mantsch
Fermilab
PO Box 500, MS316
Batavia, IL 60520
708 840 4940 voice708 840 3756

Ray Yarema
Fermilab
P.O. BOX 500; MS 222
Batavia, IL 60510
708 840 4817 voice 708 840 2950

Ed Jedlicka
Program Manager
IBM Corporation
2707 Butterfield Road
Oak Brook, IL 60521
708 573-7310 voice 708 573 7186 FAX

Paul A. Gottlieb
Chief, Office of Intellectual Property Counsel
U. S. Department of Energy
Chicago Operations Office
9800 South Cass Avenue
Argonne, IL 60439
708 252 2169 voice

Attachment 4

CEBAF Transparencies

H.F. Dylla

Technology Transfer at DOE Dedicated Program Laboratories
Fermi National Accelerator Laboratory
October 6, 1994

TECHNOLOGY TRANSFER & DEVELOPMENT AT CEBAF

H. F. Dylla

- Identifying our most useful technologies
- Success stories with small CRADA's
- Our attempts to establish a major research partnership

CEBAF AT A GLANCE

- A program dedicated DOE laboratory for basic particle and nuclear physics research, managed by the Southeast Universities Research Association (SURA)
- CEBAF's primary project, the construction of 4 GeV, 200 μA superconducting linac was completed this summer, three experimental halls begin operation over the next 2 years.
- The accelerator experimental halls and support facilities represent at \$550M DOE investment and \$50M from non-federal partners.
- Experimental operations begin in Dec. 94; over 5 years of beam time have been requested from 850 users from 100 institutions.
- Developing programs in K-12 education and technology transfer are well supported by state and local institutions.

TECHNOLOGY TRANSFER AT CEBAF

- Begün in 1990 with market survey of potential commercial interest in CEBAF technologies.

- Attention-getters:

  (1) accelerator driven light sources (particularly FELs)

  (2) particle detector technology

  (3) cryogenic and vacuum instrumentation

  (4) high capacity data acquisition system

- Formed an Industrial Advisory Board in early 1991 for guidance on the development of the most promising technology.
  - high average power free electron lasers based on CEBAF superconducting RF linac technology.

- 1991-94 CEBAF and IAB partners focussed on proposal development for an industry-led "free electron laser user facility."

SUCCESS STORIES FROM SMALL CRADA'S (1994)

X-ray/visible light detector technology

- CRADA with Digiray, Inc. (San Ramon) CA, manufacturer of a scanning X-ray device for non-destructive analysis
  - incorporation of CEBAF-designed array of X-ray miniprobes has improved sensitivity and resolution.
  - expanded commercial market of device to inspections of corrosion in difficult geometries (inside piping, wing struts)
  - improved device now at NASA-Langley for testing under a NASA SBIR-Phase II.
  - new project with Digiray/NASA under negotiation to develop a high resolution laminography system.

VACUUM / CRYOGENIC INSTRUMENTATION

- CRADA with MKS Instruments, Inc. (Andover, MA), manufacturer of vacuum and pressure instrumentation.
  - develop a prototype high sensitivity leak detector based on CEBAF's patented He desorption methodology.
  - sensitivity of prototype instrument $\leq 10^{-13}$ atm-cc/s (10^3 better than existing commercial instruments)
  - will incorporate new cryosorbing material developed at CEBAF (patent pending) that has also attracted interest from commercial cryopump manufacturers.

FEL DEVELOPMENT PARTNERSHIP AT CEBAF

- IAB identified industrial applications of high average power lasers for material processing and the need for technology development.
  - guided CEBAF's program plan for FEL development
  - identified pre-competitive laser processing technology to be developed at CEBAF.
  - pledged $9M of user equipment and supporting labor.
- Partnership was broadened in 1993 with formation of the Laser Processing Consortium.
  - led by DuPont (M. Kelley, Chair), other industry members include: AT&T, 3M, IBM, Xerox, Grumman and Newport News Shipbuilding.
  - university members: William & Mary, Old Dominion University, Hampton University, University of Delaware and North Carolina State University.
- LPC has attracted considerable state and local government support
  - $5M Commonwealth of Virginia (FEL funding)
  - $13M City of Newport News (laboratory/office building)

LASER PROCESSING CONSORTIUM PROGRAM

Phase 0: Electron Gun Test Stand (underway)

- build and test electron source technology for FELs
- co-funded by DOE ($5.5M) and VA ($2.0M)

Phase 1: UV/IR Demo (1996-98)

- kilowatt demonstration FEL's spanning IR-UV (20-0.2 μm)
- 3 year, $32M construction project, includes $5M user facility for industry process demonstrations.
- Project given high marks by an industry/national lab peer review team sponsored by NASA in March 1994.
- $27M of Federal support being solicited to match non-Federal contributions

Phase 2: Industry Prototype

- high power (25-100 kW) prototype for industrial processing.
- industry partners co-develop prototype hardware.

INDUSTRIAL APPLICATIONS OF THE CEBAF FEL

- Surface processing of polymers
  - DuPont, 3M, Xerox
- Composite fiber activation/composite curing
  - DuPont, Northrop-Grumman, NASA-Langley
- Micromachining of metals, ceramics, composites
  - 3M, Siemens
- Surface processing of metals
  - GM, Ford, Newport News Shipbuilding
- Process monitoring of semiconductor desposition systems
  - AT&T, IBM
- Large area electronic material deposition/etching
  - AT&T, IBM, Xerox

THE LASER PROCESSING CONSORTIUM

AN INDUSTRIALLY-DRIVEN

TECHNOLOGY PARTNERSHIP

Michael J. Kelley
DuPont Central Research

MANUFACTURING SUCCESS IN THE GLOBAL ECONOMY

- More product value
- Less resource intensity
- More customer responsiveness
- Reduced environmental impact

PROCESSING WITH LIGHT

- o Attractive applications
  - Polymer surface modification
  - Micromachining
  - Chemical processing
- o Attractive processes
  - Environmentally friendly
  - Spatial and chemical precision
  - End-of-line flexibility

PUTTING IT TO WORK

- Demonstrated with excimer lasers
- Unacceptable costs
- Insufficient capacity
- No suitable light source technology

Need a technology partner

CEBAF: A TECHNOLOGY PARTNER

- o New, modest-sized laboratory
- o Committed, effective people
- o Manufacturing organization
- o SRF accelerator and FEL technology
- o Excellent state and local support
- o Strong synergy with main mission

THE LPC: A TECNOLOGY PARTNERSHIP

o Began in 1991 as Industrial Advisory Board
  - AT&T, DuPont, IBM, NNS&D, Northrop Grumman, 3M, Xerox

o Proactive involvement by all

o Mission-oriented

o Defined needed technology and made proposal

o Enlisted university partners

o Research teams are already at work

Attachment 5

FNAL Transparencies

T. Nash

Technology Transfer at DOE Dedicated Program Laboratories
Fermi National Accelerator Laboratory
October 6, 1994

Technology at Fermilab Opportunities & Challenges

Workshop on Technology Transfer at Dedicated Program Labs

October 6, 1994

Thomas Nash
nash@fnal.gov

Fermilab
US Department of Energy

Enabling an industry

Exporting Fermilab Technology

The Tevatron: the first superconducting accelerator

Collaboration with US. manufacturers

fast-forwarded infant superconducting industry

to billion $ role in world MRI market

High-energy physics did not invent MRI

but it did push superconducting technology out of the nest, so that when MRI came along, the industry was ready to fly.

"Every program in superconductivity ... today owes itself in some measure to the fact that Fermilab built the Tevatron and it worked."

Robert Marsh
Teledyne Wah Chang (largest supplier of supercon alloys)

Fermilab
US Department of Energy

Cryogenic Technology

Magnet design & fabrication know-how

Reentrant cold mass supports
for superconducting magnets &
other cryo devices (low temp tensile testers)

Methods for designing coil end supports for
high field superconducting magnets

Precision tooling for superconducting
magnets using stamped laminations

QA systems for fabrication of
superconducting magnets

Measurement of magnetic field alignment

Cryogenic Technology (cont.)

Development of cryogenic tools & techniques

Joining techniques for composite & metals
permits service over wide temp range to LHe temps

Techniques, equipment for fabricating multilayer insulation blankets

Measurement of heat leaks at cryo temps

Small cryocoolers (10-50 watts @ 20K) for LH2 targets & many commercial applications

Commercialization & scale-up of superconducting technology

Wire & cable fabrication

Precision in line measurement of cables

Development, operation, maintenance of large scale helium refrigeration

Medical Accelerators

First proton accelerator just for medicine

Loma Linda Medical Center (California)

Designed & commissioned by Fermilab (WFO)

Proposed LINAC Experimental Area

Pulsed-beam scanning for proton therapy.

Develop detectors & methods for 3-D dose distribution measurements.

Measurements of dose distributions as functions of beam properties.

The relationship of beam optics to gantry design.

P~~h~~roton radiography and computed tomography research & development.

Medical calibration studies.

Micro Strip Gas Chambers

Very sensitive electronic “film” with 35 μ resolution

- 2 D readout with precise energy measurement,
- single particle detection, high counting rates.
- gas detector using microelectronics litho process

X-ray images at extremely low dosages

- instant images
- X-ray movies possible

Driven by needs of high energy physics, broad applicability

- medical: live biopsy • DNA analysis • mammography
- mechanical: analysis of welded seams

Plastic scintillating fiber

Medical applications:
inter-ocular lenses • blood gas monitors
environmental sensors

Development of new fluorescent compounds

Inorganic scintillators: cerium, barium, lead flourides

Radiation effects study on polymer systems

Scintillating fiber readout
Visible Light Photon Counters (VLPCs)

hi sensitivity cryo avalanche photodiode.

DOD sponsored technology

Fermilab and Rockwell developing commercial applications

Quad preamp IC readout for VLPCs

Plastic scintillating fiber
Formulation, process, & fabrication technology (cont.)

Processing of optical/scintillating fiber

New cladding materials for plastic optical fiber

Plastic scintillator grooving for wave shifter fiber read out

Plastic fiber end diamond machining

automated precut/cut/fine cut cycles

Fiber clamp to prevent sheath smearing during machining

Low loss plastic fiber splicing (U. Michigan)

Highest precision

Silicon detectors

Replacement of X-ray film with amorphous silicon detectors and readout electronics (CRADA U. Michigan)

Double-sided silicon microstrip sensors, double-metal technology

Thin film technology hybrid for high line densities

Custom IC read out

- on-chip digitization
- programmable bandwidth
- switched capacitor pipeline

Readout with new large Rad-Hard FPGSA (Harris)

Dense-optical ribbon cable driver/receiver (Hitachi)

Fermilab
US Department of Energy

High energy physics detector technology (cont'd)

Plastic optical fibers

New photocathodes

Secondary electron emission (faster timing)

Large scale CCD electronics for astrophysics

Digital PMT (charge integrator/encoder)

Fast scintillator crystal for use in medical imaging (PET)

Analog & Digital • Picoamps to 10,000 A • DC to RF

High energy physics led industry with bus/crate standards

- NIM,CAMAC, Fastbus
- FASTBUS features in VME, Futurebus+ and SCI standards

LAN & telecom switches for high data rate access and assembly.

Computer controlled DCHV power supply for DZero

- licensed to Loma Linda Medical Center

Multi-kiloamp, 1000 volt solid state dump switch

- superconducting magnet quench protection
- 10,000A @ 1000 V in 150 μsec
- R&D 100 Award Winner

Innovations in mechanical engineering

Robotic internal repair of buried pipe

Miles of buried beam pipe critical to operations

- Oil & gas industry have same problem.
- Cost to dig and replace is high
- Fermilab repairs corrosion leaks internally using robotics
- Locate leak, prepare surface, & epoxy metal patch to pipe wall

Cut 9 ft diameter pipe to tight tolerance pushing technology

Isogrid/Honeycomb shells for large vacuum vessels

- first use to scale and tolerance required here

Innovations in mechanical engineering (cont.)

Extruded aluminum conductor for magnets.

First production of large cross-section (1.5 ” sq.),

5000 ft continuous lengths of conductor

“conforming” (cold extrusion) process.

Modular tornado shelter

remote sites at Fermilab, schools, trailer parks, etc.

Nesting closed extrusions for platforms, billboards, etc.

Dynamic dust seal for air bearing spindles used for abrasive materials.

Micro light-spots for semiconductor wafer response scanning.

Innovations in mechanical engineering (cont.)

Identification of environmentally safe cleaning processes

Laser light calibration systems, including doubling & scintillating excitation to match spectra

Radioactive wire source scanner to map calorimeters (potential for radiography)

Measurement, Alignment, Surveying

- Capacitive probe techniques
  - cost, convenience, & accuracy better than touch-trigger probes
  - used on coordinate measuring machines
    - for silicon wafers, mirrors, etc.
- Stretched wire transducers
- Automatic ballbar
  - calibration in coordinate measuring machines
- Electronic precision liquid level • Superstable electronic tilt meters
  - ground motion/precision alignment monitoring to 0.1 mm
- Reflective ball targets (replace bull's eyes)
  - cramped poor access surveying

Fermilab CRADAs

U. Michigan

ASICs for readout of the first clinically practical, flat-panel, solid state digital image for real time radiotherapy treatment verification.

Cray Research, Inc.

Porting CANOPY tp the Cray T3D Supercomputing System

Chicago Precast Products Co.

Design, build, test and demonstrate an affordable, modular, prefabricated above ground tornado shelter

Fermilab CRADAs - Continued

Extrude Hone Corp.

Development and commercialization of capacitive probe technology for automatically calibrating coordinate measuring machines

IBM (Pending)

Explore and demonstrate systems and tools for data mining and analysis in a scalable parallel computing environment

Fermilab/URA Licenses

Omnibyte Corporation, West Chicago, Il
Second Generation ACP Software

Instron Corporation, Canton, MA
Compact cryogenic support & low temperature loader

SRDC Software Marketing Products Div., Milford, OH
Computer aided design product usage

Superconductivity, Inc., Middleton, WI
Cryogenic support member

Brobeck Div., Maxwell Laboratories, Inc., Richmond, CA
Fermilab ACNET Accelerator Control System

Loma Linda University Medical Center, Loma Linda, CA
Computer controlled high-voltage power supply

Extrude Hone Corp., Irwin, PA
CMM Automatic Ball Bar

Fermilab R&D 100 (formerly IR-100) Awards Won

Negative Hydrogen Source - 1980

Energy Saver Dipole Magnet - 1980

Electron Cooling System - 1981

Tevatron Helium Transfer Line - 1983

Slip-Ring Stepping Motor - 1983

Precision Electric Current Sensor - 1983

ECL CAMAC Ultra High Speed Computer - 1983

Spectrographic Nitrogen Detector - 1984

Magnetic - Wire Position Transducer (MWPT) - 1985

Video Data Acquisition System - 1985

ACP Multimicroprocessor System - 1986

ACP Multi-Array Processor System (ACPMAPS) - 1986

Multi KiloAmp, 1000 Volt Solid State Dump Switch - 1991

Fermilab Industry/Laboratory Technology Exchanges

Omnibyte Corp. / Research Division

ACPMAPS

General Dynamics, Space Systems / Technical Support

Superconducting Magnet Fabrication

Babcock & Wilson Co. / Technical Support

Superconducting Magnet Design

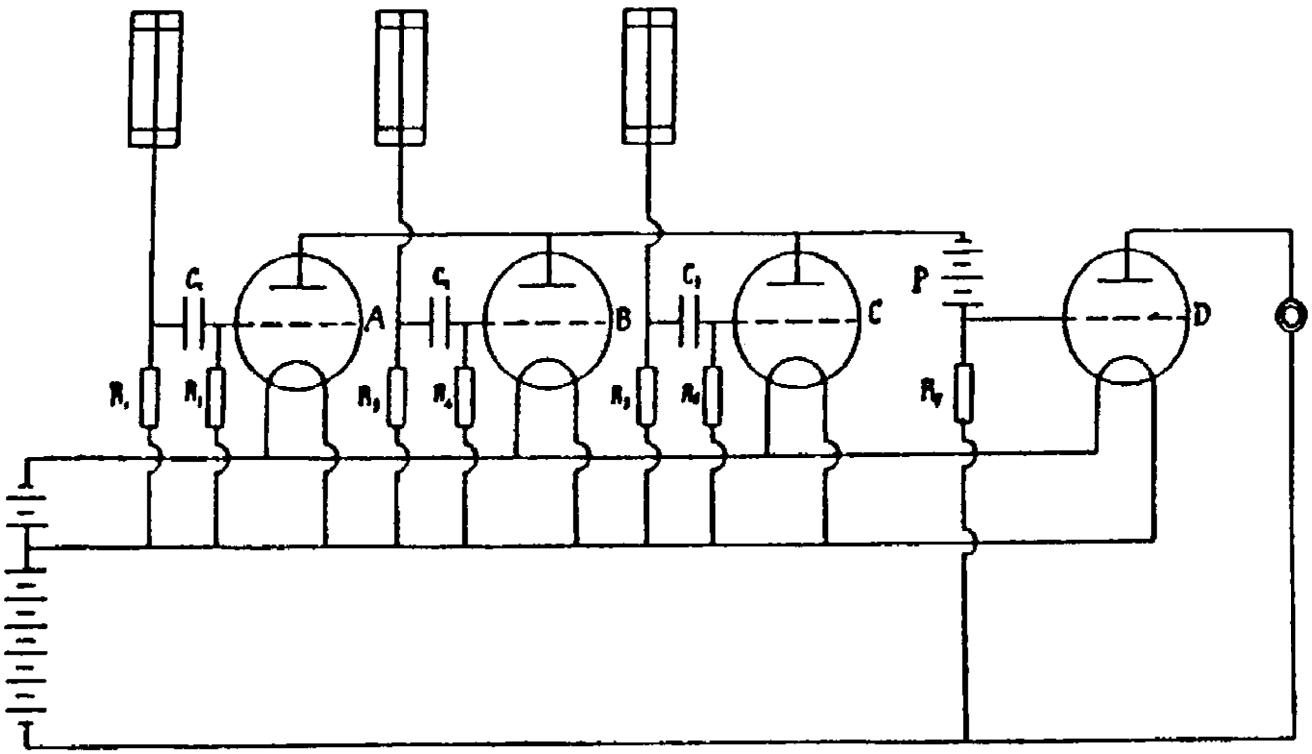
Martin Marietta Corp., Strategic Systems /Accelerator Division

Accelerator Control System

The first AND gate

A long history of digital technology in HEP

... even before Fermilab



Triple coincidence of Geiger counters (~1930)

Fermilab
US Department of Energy

Fermilab is a recognized pioneer in High Performance Computing

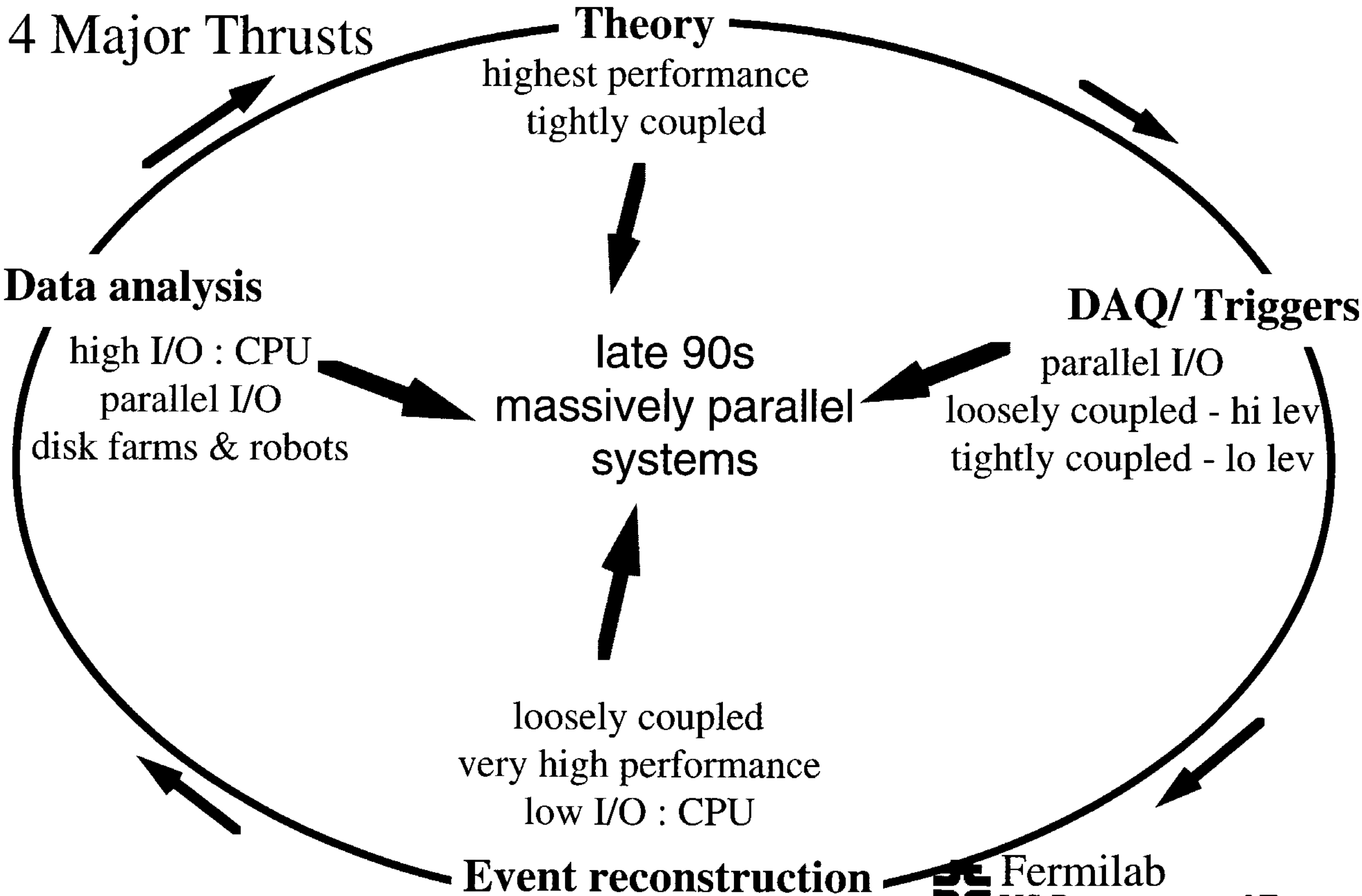
Workstation clusters -- Fermilab's reconstruction farms
probably the first and the largest clusters

Massively parallel systems -- Fermilab's ACPMAPS
probably the most powerful doing full production science
in effective use for years

Fermilab development of production parallel computing:
emphasis on ***production*** rather than ***parallel***

Fermilab
US Department of Energy

Fermilab Parallel Computing
4 Major Thrusts



External recognition

Buzbee panel report to DOE/ER (November 1991)

"Fermilab has a critical mass of talented people who have an impressive track record in advancing and applying HPC technology.... Fermilab is one of the world's leading laboratories in cluster technology and parallel computing.... We believe that their accumulated experience and success with clusters and parallel computing constitutes a potentially valuable resource to the broader computing community, and especially to domestic suppliers of computing technology."

Fermilab
US Department of Energy

External recognition

HPC Wire report on Supercomputer 92 Conference (November 1992):

"Minneapolis, Minn. -- At Supercomputing '92, clusters moved from the sandlots and minor leagues of high-performance computing into the major leagues.
... The first instances of systematic clustering known to this reporter took place at the Fermi National Laboratory, beginning in 1985-86."

External recognition

Government Computer News: Agency Award of Excellence (October 1993)

"... for the successful decade-long effort to bring high performance parallel computing to ... demanding production requirements... Fermilab pioneered in the two widely accepted areas of parallel computing: work station clusters and massively parallel computing. ... The technologies brought into production by Fermilab's pioneering efforts have obvious application in ... the operations of the government."

Fermilab
US Department of Energy

5 lbs caviar in a 1 lb can

Driving the challenges: HEP must do more with less

Trade-off: luminosity for energy

SSC --> LHC • HERA • MI & TeV* • B factory
10^{32} 10^{33} 10^{34}

LHC: 40 interactions every 24 nsec

data generated at front of pipe: ~40 10^6 x 10^6 ~ 4 10^{13} = 40 PB/sec

Requires pipelined data acquisition

Multiple stages of sophisticated triggers

Off-line: Petabytes of complex data

data handling and management

Doing more with less ... (II)

More physicists + less experiments = larger collaborations

- more, smaller, scattered university groups
- 400 is now (soon) a small collaboration

Shared access to data

Shared development of software

Shared writing/approval of publications

HEP developed WORLD WIDE WEB to meet this need

Doing more with less ... (III)

Internationalization of large facilities

inter-regional network and video
facility management and governance

accelerator development and operation

detector collaborations

Remote control rooms

Remote diagnostics

Remote access to data

"So...
What do Quarks have to do with Business?"

Thomas Nash
Fermi National Accelerator Laboratory
Batavia, IL 60510
nash@fnal.gov

Commercial Parallel Processing Conference
Chicago
September 12, 1994

Fermilab
US Department of Energy

Serving data & computing for analysis:
A real opportunity to be relevant

High energy physics drives a production data intensive environment which resembles commercial computing requirements

- data mining style of analysis
- large collaborative access

Access to data a recognized bottleneck on today's parallel computers

Internet bottleneck is data service (see NY Times 11/3/93, p 1)

- public access to Information Superhighways
- requires parallel I/O data servers

Fermilab - IBM collaboration in this area

American business
becoming more and more analytical

- Airlines • credit card companies • market researchers
  - accumulating and analyzing consumer purchase data
- Executive philosophies like Total Quality Management (TQM)
  - dictum: "measure everything"
- Financial markets
- Science and business data
  - subject to same statistical techniques
  - have (will have) same demands on compute & data service

Believe it or not

How particle physics data analysis is like commercial data analysis?

- Market research is an example
  - Analysis of consumer buying
  - Supermarkets and other mass merchandise outlets
- Analyzing bar codes on weekly basis -- soon daily
- A shopping basket "event" like an accelerator event
  - correlation of particles -- quarks and leptons
  - correlation of purchases -- muffins and jam
  - mass calculations -- purchase clusters
- Statistical analysis
  - shopping events like HEP events

Fermilab
US Department of Energy

How we transfer technology

- Informal

    industry “vendor visits”

    conference presentations

    personnel transfers (exchanges & industry hires)

- After the fact

    release and support of products, licensing

- Real time

    procurement: work with vendor to meet our needs

    collaborative development (CRADAs)

        leverage Fermilab & industry needs & technologies

Intensive focus on unrelenting needs of the science

Meeting the expectations of the scientific community

Science is the powerful technology driver

- It's why our technology is so valuable to the nation's competitiveness

It carries with it a very internalized culture

- a focus on near term problems
- a surprising tendency towards risk aversion
  - isn't science supposed to take risks?

Intensive focus on unrelenting needs of the business

Meeting the expectations of the stock market

Profit is the powerful technology driver

- It's why US technology is so competitive

It carries with it a very internalized culture

- a focus on near term problems
- a surprising tendency towards risk aversion
  - isn't business supposed to take risks?

Why are we having so much trouble?

Corporate & lab cultures resist external intimacy

- “collaboration” has different meaning
- not invented here

Collaborations need trans-corporation/lab champions

Importance of a “sweetener” as tangible evidence of leverage

- Industry likes to sees government $$
- Government likes to see corporate $$
- Scientists just like $$$

Increasing DOE/LTT funding is extremely helpful feeling rejected

Exporting Fermilab Technology

The Proposals We Have Submitted

- **OSC 2/28/92 $100K**
  A Program for Parallel Computing in Industry (Merck)
- **DARPA 5/13/92 $0**
  Fermilab-Intel Collaboration to Accelerate Development of Cost-Effective TeraFLOPS Computing Systems
- **OSC 5/5/93 $0**
  Second Year Funding for Fermilab-Merck Collaboration
- **OSC 7/6/93 $0**
  ...Parallel Computing in Industrial Research, Phase 2
- **LTT & OSC 4/26/93 $0**
  Technology Transfer of Fermilab Parallel Computing Know-how and Software
- **LTT& OSC 4/26/93 $0**
  From Parallel Computing to Parallel Data: A Fermilab-IBM Project

Fermilab
US Department of Energy

Why are we having so much trouble? (cont.)

- CRADAs are ponderous
  - the ?only? way to keep score
- CRADAs and procurement
  - industry expectations
  - but do they mix? LANL-Cray problems
- Intellectual property rights
  - freedom of information act fears
  - CSPP CRADA
    - results free to "DOE Labs"
      - BUT labs were traditional source of R&D costs
  - Merck frightened by CRADA

Outreach is surprisingly controversial

- Leveraging our technology: why?
  - our nation considers competitiveness a priority
    - for better and for worse
      - scientific budgets are often justified
        - ... by our technology
  - our science depends on technology
    - the best way to access technology is
    - bring your own to the table and share
- Overcome the challenges
  - emphasize: it's WIN-WIN
    - ... and grease the ways

Fermilab
US Department of Energy

Attachment 6

PPPL
Transparencies

L. Meixler

Technology Transfer at DOE Dedicated Program Laboratories
Fermi National Accelerator Laboratory
October 6, 1994

Princeton Plasma Physics Laboratory

PPPL

Technology Transfer at the DOE Program Dedicated Laboratories

Office of Technology Transfer

October 6, 1994

Lewis D. Meixler
Head of the Office of Technology Transfer

Outline

PPPL

- Personnel Exchanges with Industry
- Work for Others Project (Non-Federal)
- CRADA Activity
- Technology Maturation
- Outreach
  - PPPL/NASA-Center for Technology Commercialization
  - SBIR, STTR, FLC, CARR, ETC.
- Major Partnership
- Technology Focus Areas
- FY94 Licensing
- Technology Areas of Current Interest
- Introduction and Comments from Industrial Partners

CRADAs

CRADA Activities

PPPL

Status:

6 CRADAs

1 under negotiation

CRADA

Sapphire to Metal Bonding Technique

PPPL

- CRADA to develop process for bonding sapphire lenses and envelopes to metal electrodes for the manufacture of a new class of high-intensity lamps.
- Rapid Thermal Drying, High Definition Photography, Robotics, and Semi-Conductor Lithography.
- Participant: Saphikon Inc. (small business)
- Funded from PPPL research program - OFE
- Total valuation: $85,000
- Status: Initial Prototype High Intensity Lamp Developed

CRADA

Plasma Chemical Synthesis

PPPL

- PPPL will verify whether a certain proprietary chemical can be synthesized in a plasma with commercially viable yields and purity.
- Participant: Fortune 500 Chemical Company
- Total valuation: $100,000
- Funded from PPPL research program - OFE
- Status: Chemical Reactor construction in process

CRADA

Advanced Computer Modeling Environment Project

PPPL

- This CRADA is directed at the development of a high-level computational environment which allows diverse computational modules to be rapidly and easily integrated into a computer model by the end user. Applications exist both in the fusion energy program and the commercial sector.
- Participant: Dynamic Research Corporation
- Project Valuation: $120,000
- Funded from PPPL research program - OFE
- Status: Software development underway

CRADA

Chemical Tracking and Waste Reporting System

PPPL

- CRADA to enhance the Chemical Tracking and Report Generating System implemented at PPPL for commercial applications. Provides industrial users of chemicals the means to generate all necessary EPA state and Federal forms, and database information regarding purchasing, storing, monitoring and using chemicals.
- Participant: Vertére Inc. (women-owned, small business)
- Project Valuation $115,000
- PPPL costs supported by EM-30
- Status: Project started

CRADA

Advanced Computer Modeling AMBER and SAGE

PPPL

- This CRADA is directed at the development of a high-level computational modeling environ-ment which allows users to combine a large array of existing programs, written in various languages into a single, user friendly environment.
- Participant: Dynamic Research Corporation
- Project Valuation: $810,000 over three years
- Funding - Energy Research Lab Technology Transfer (ER-LTT)
- Status: Development underway

CRADA

Investigation of Low Energy Electron Beam Behavior in Air

PPPL

- CRADA to investigate low energy electron beam behavior in air:
  - related to manufacture of electrostatic atomization technology
  - applications in spraying liquids and powders in ways which are environmentally and economically superior to current methods.
- Participant: Charged Injection Corporation
- Project Valuation: $135,000
- Funding - ER-LTT
- Status: Development underway

Personnel Exchanges with Industry

PPPL

Two Personnel Exchanges funded by ER-LTT:

Advanced Digital Feedback Techniques

PPPL Electronic Engineers and David Sarnoff Research Center researchers are developing miniaturized power supplies and DC/DC converters for industrial and commercial applications.

Magnetic Codes for Electron Beam Lithography

PPPL Engineers and AT&T Bell Labs are developing computer codes for the design of magnetic field trajectories (magnetic lens) for electron beam etching of integrated circuits.

Work For Others Project (Non-Federal)

PPPL

One Work For Others project in process, and one in early stage of negotiation:

Development and calibration of Nuclear Particle Detectors for applications in Nuclear Non-Proliferation.

Small business spinoff from David Sarnoff Research Center and PPPL researchers are developingt new radiation detectors for Non-Proliferation applications. Potential collaboration with the DOE Environmental Measurements Laboratory in New York City.

Diagnostics for Plasma Assisted Projectiles

Applying plasma diagnostics techniques to characterize and improve the performance and repeatability of Plasma Igniters for Plasma Assisted Projectiles with a major defense supplier.

Technology Maturation

PPPL

PPPL has partnered with CALTECH on the development of magnetic techniques to stabilize arcs in Arc Furnaces:

Major issue to the steel industry

Spin-off applications in the waste minimization - Soil Remediation Technology

Small scale prototype is under construction at PPPL

Funded by ER-LTT

Current discussions with industry partner *Asea Brown Boveri*, world's largest Arc Furnace Manufacturer for a multi-year CRADA to carry the technology forward.

Outreach

PPPL

PPPL/NASA-New Jersey -Center for Technology Commercialization:

- CTC works closely with PPPL, and other Federal Laboratories, N J Commission on Science and Technology & Small Businesses.
- Promotes Technology Transfer using NASA's Technology Transfer resources and databases. Good one on one contact.

Located at PPPL

PPPL donates facilities

NASA provides financial support.

Outreach (Continued)

PPPL

- Active in helping small businesses respond to SBIR and STTR solicitations.
- Active in supporting the Federal Laboratory Consortium in the North East.
- Contact with small businesses in the Rutgers University Small Business Incubator (CARR).
- PPPL attends major Technology Shows such as NASA's Technology 2004, Tech Ex, and regional conferences.

Major Partnership - AMTEX

PPPL

AMTEX CRADA

- PPPL has been added to the membership of the AMTEX Laboratory Board in August 1994.
- PPPL is actively involved with the Princeton Textile Research Institute (TRI) on the identification of technologies relevent to TRI's area of interest and PPPL's abilities.
- PPPL is working with TRI on other textile related issues relevant to the Northeast, such as potential program development at the College of Textiles and Materials Science (Philadelphia, Pennsylvania).
- PPPL is participating with TRI on the development of a North East Textile Center (A consortium comprised of Cornell, M.I.T., College of Textiles and Material Science, UMASS, Fashion Institute of Technology.).

Technology Focus Areas

PPPL

Low Temperature Plasmas

- Hyper-Thermal Neutral Beam Source for Plasma Beam-Surface interaction studies related to Material Science
- Part of Princeton University Physics Graduate Studies
- Spacecraft Component Lifetime Evaluation
- Semi-Conductor Fabrication, Deposition & Etching
- Potential Bio-medical Applications of Plasma Processes
- Collaborative links with Stevens Institute, Rutgers, NJIT William & Mary, AT&T, IBM, WPAFB, Sarnoff, etc.

Technology Focus Area (Continued)

PPPL

<u>Advanced Modeling Sciences Laboratory</u>

Aim - A combination of disciplines to advance the field of Computer Modeling:

Three Components:

- Modeling Theory (Complex Systems, Chaos, Advanced Robotics)
- Science Education (using modeling in the learning environment)
- Industrial Applications (PPPL's 3 year CRADA - DRC)

Headed by Dr. Russell Hulse (1984 Nobel Prize Winner), Physicists, Computer Scientists, and Science Education Staff.

Licensing

PPPL

Two technologies were licensed this year through the Princeton University ORTA:

XMACRO - A license with the American Institute of Physics for software developed for the telephonic transmission of documents with many embedded equations.

Chemical Waste Tracking and Report Generating System - A license with our CRADA partner, Vertére, for the PPPL software for tracking and reporting chemicals at the laboratory.

AREAS OF CURRENT INTEREST

PPPL

Physics

- Synthesis and Destruction of Chemicals in Plasmas
- Plasma Diagnostics such as spectroscopy, laser probes
- Plasma Processing of Semiconductor Devices
- Plasma Aided Ignition for Internal Combustion Engines
  - (Seeking potential CRADA partner)
- Plasma Arc Stabilization (Evaluating CRADA partners)
- Plasma-Beam Surface Interaction for material science and manufacturing processes
- Plasma Modeling

AREAS OF CURRENT INTEREST (Continued)

PPPL

Engineering

- High Power RF and Microwaves
- Metal to Ceramic Bonding
- Copper Alloy Property Enhancement and Welding
- Electro-magnetic Analysis
- Seismic, and Structural Design and Analysis
- Vacuum Engineering and Vacuum Welding
- Neutral Beams
- High voltage & High Current Engineering
- Electronics - Analog, Digital, Computer, Feedback.

AREAS OF CURRENT INTEREST (Continued)

PPPL

Computer Applications

- Computer Aided Drafting and Design
- Database Visualization Applications
- Expert Control Systems and Neural Networks
- Advanced Modeling Techniques.

Environmental Health and Safety

- Radiation Monitoring Technologies
- Industrial and Laboratory Safety Training

Summary

PPPL

- PPPL is active in numerous Technology Transfer mechanisms
  - CRADAs, Personnel Exchanges, Technology Maturation, Work For Others, Contact with Small Business, Licensing, Outreach.
- PPPL has significant Technology Focus Areas highly relevant to industry
- PPPL is currently developing additional Technology Focus Areas
- Given More Resources - PPPL could increase its effectiveness as a Technology resource to U. S. industry.

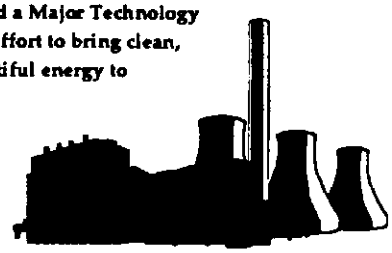
What is It?

PPPL

Fusion Energy

PPPL

PPPL's Fusion Energy Research Efforts can be considered a Major Technology Transfer effort to bring clean, safe, plentiful energy to Mankind.



Attachment 7

SLAC Transparencies

D. Leith

Technology Transfer at DOE Dedicated Program Laboratories
Fermi National Accelerator Laboratory
October 6, 1994

SLAC Opportunities

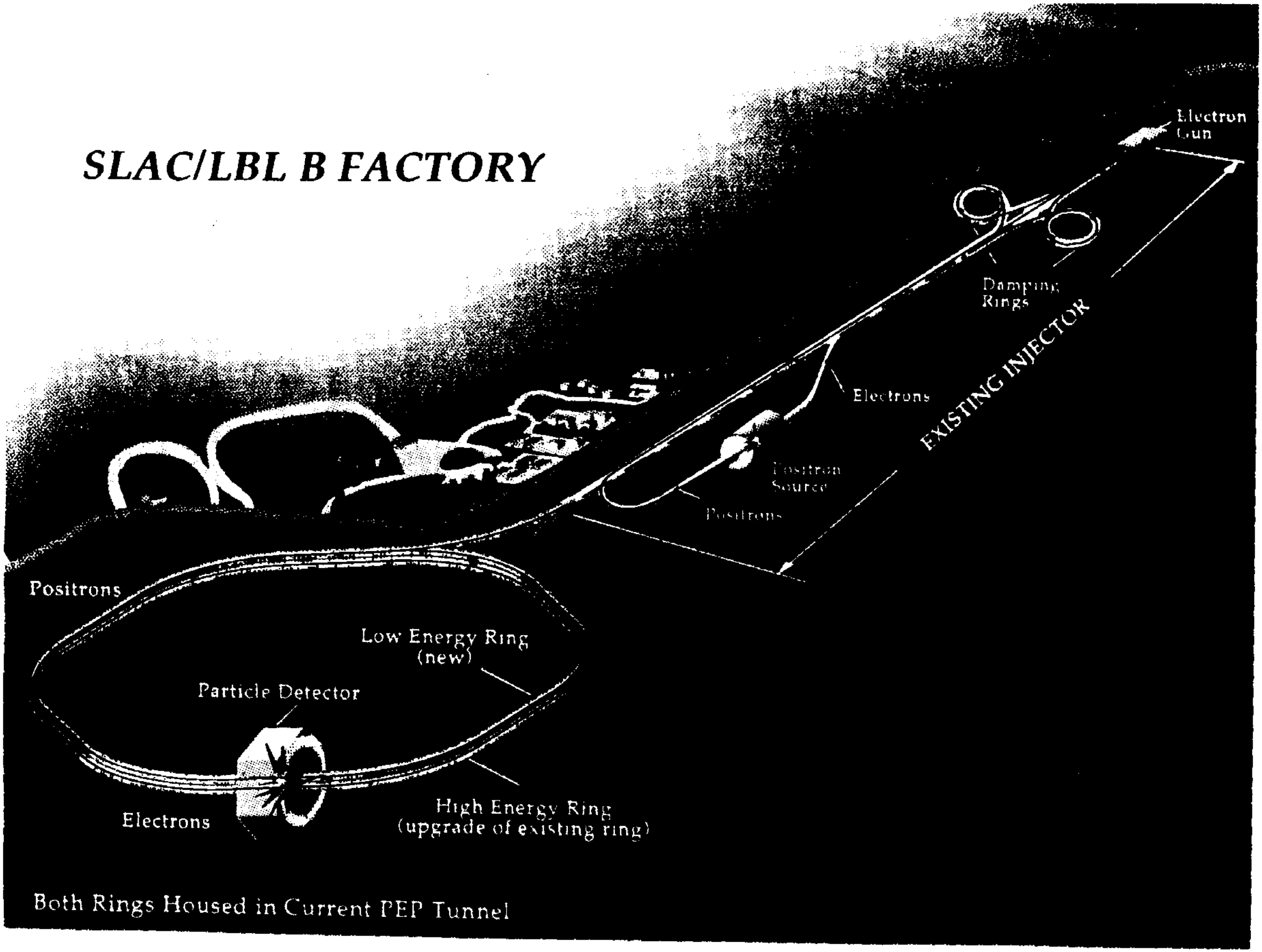
"Extraordinary Opportunities
at the
Dedicated Program Labs"

October 6, 1994

1) Lab speaker — David W.G.S. Leith, Director of Research

2) Industry speaker — Stephen Laderman, Hewlett Packard Co.

SLAC/LBL B FACTORY



Stanford Linear Accelerator Center

High Energy Physics		Synchroton Light
	Budget	
$120 M	(on-going support)	$17 M
$44 M	(construction)	$5.4 M
1300	***Staff*** (about half of the laboratory staff are degreed professionals)	130
771	***Users***	956
143	Institutions	138
60	Universities	49
--	Industry	31
11	Government Labs	16
72	Foreign	42

HEP	SSRL
• Experiments are done by teams of 100's of scientists, having taken years to build, a few years to gather the data and a year to analyse.	-- by teams of a few scientists, taking days & weeks to prepare and t same to take the dat Analysis is typically rap
• Teams are usually collaborations of lab staff and university professors and students.	-- are a mixture of lab, university and <u>industry</u> scientists. For example, 1/3 of the expt. this year had industry collaborator.
• 4 expts were partially run in the 8 continuous months of running in 93/94.	343 expts were run in SSRL in 1994.
• Staff build and run the accelerators, and help build & do the expts.; develop new instrumentation & run a large computing facility.	- operate SSRL, & develop new devices; work with users to support their access utilization of the faci

SLAC Core Competencies

The laboratory has developed competencies in several technical arenas in the process of carrying out its missions. These are summarized in the following points.

Electron Accelerators
- high-energy, high-intensity, low-emittance linacs
- polarized beam sources
- high-current storage rings
- linear colliders
- free-electron lasers

Synchrotron radiation
- high brightness sources
- large-scale user facilities
- biological & materials science
- environmental and industrial process studies

Particle detection
- charged-particle tracking
- precision vertex detectors
- calorimetry
- particle identification
- x-ray imaging
- design & integration of large-scale facilities
- data acquisition, online monitoring
- high data rate & high bandwidth computation
- database management

Critical technologies
- high-speed computing & networking
- advanced electronics & VLSI IC design
- rf power sources: pulsed & cw klystrons
- large-scale ultra high vacuum systems
- radiation physics & monitoring
- magnet design & measurement

Industrial Research Active at SSRL
August 1994

ADELPHI TECHNOLOGY*	CRADA
ALCHEMIST TECHNOLOGIES*	USE
ANERGEN*	COL
AT&T BELL LABORATORIES	COL
CHEVRON	USE
CHIRON CORPORATION	COL
DANA FARBER CANCER INSTITUTE	USE
DUPONT-MERCK PHARMACEUTICALS	USE
E.I. DU PONT DE NEMOURS & CO.	USE
EXXON RESEARCH & ENGINEERING	SUP/USE/COL
FISIONS INSTRUMENTS	SUP/COL
GENENTECH, INC.	USE
GENERAL ELECTRIC CO.	USE
HEWLETT PACKARD	SUP/USE/COL/CRADA
HIRSCH SCIENTIFIC*	USE
IBM RESEARCH LABORATORY	SUP/USE/COL
INTEL CORPORATION	SUP/USE/COL
MONSANTO COMPANY	USE
MORRIS RESEARCH, INC.*	USE
OVONIC SYNTHETIC MATERIALS CORPORATION (OSMC)	CRADA
ROCKETDYNE	COL
SURFACE INTERFACE	COL
SYNTEX RESEARCH	COL/USE
THE EXAFS COMPANY*	USE
WACKER-CHEMITRONIC	COL/USE
X-RAY INSTRUMENTATION ASSOCIATES*	USE
XEROX	USE
XSIRIUS, INC.	COL/USE

*SMALL BUSINESSES

Categories are use = user, col = collaborator with in-house staff, sup = support for beam lines or instrumentati
CRADA = CRADA partner

Joint Research Projects

HEP	SSRL
High Power r. f. Klystron *(VARIAN)*	**Micro Contamination Studies** *(HEWLETT-PACKARD, INTEL)* *
CCD Detector for Mammography *(AURORA, THERMOTREX)*	**Industrial Beamlines** *(IBM, ATT)*
Batch Processing System for Distributed Computing * *(IBM)*	**Biomedical Research** *(SYNTEX)*
Client Software for Mass Storage System *(STK)*	**X-Ray Optics** *(ADELPHI, OVONICS)*

* In discussion.

* Prelim study approved; major program in discussion.

Opportunities in HEP:

- Developing new kinds of accelerators
- Developing new kinds of high pulsed power radio frequency equipment -- klystrons, modulators, etc.
- Development of new kinds of instrumentation for particle detection and control systems. Applications for medical and industrial instruments.
- Computing for HEP experiments:
  - 10^4 MIPS per experiment
  - 100 Mbytes/sec networking
  - 75 Tbytes/year storage
- Electronics design and implementation.

Motivation

To demonstrate the application of synchrotron-based analytical techniques to the study of epitaxial growth of GaAs in order to improve understanding of:

Nature of the growing film and any similarities to MBE growth.

Basic physics and chemistry of materials preparation using CVD.

Phenomena through which indirect methods may be applied to process control.

In Situ Grazing Incidence X-ray Scatttering During GaAs Epitaxial Growth

D.W. Kisker and G. B. Stephenson
IBM Research Division
Yorktown Heights, NY 10598

P. H. Fuoss and F. J. Lamelas
AT&T Bell Laboratories
Murray Hill, NJ 07974

S. Brennan
Stanford Synchrotron Radiation Lab
Menlo Park, CA 94025

P. Imperatori
CNR-ITSE
Rome, Italy

Techniques Used in This Work

Grazing Incidence X-ray Scattering (GIXS)

Used to study surface reconstructions and surface roughness (crystal truncation rods)

X-ray Fluorescence (Vapor Phase)

Used to monitor gas phase composition during flow transients in order to characterize the time dependent behavior of the reactor.

Extended X-ray Absorbtion Fine Structure (EXAFS and NEXAFS)

Used to monitor the chemical nature of the growing surface and to monitor chemical reactions during growth.

Conclusions

Synchrotron-based x-ray analytical techniques have been successfully applied to the study of several aspects of OMVPE of GaAs:

Fluorescence monitored to determine the time response of the reactor.

First observation of roughness induced intensity oscillations during CVD.

Determination of state of surface during growth:
- NO RECONSTRUCTION

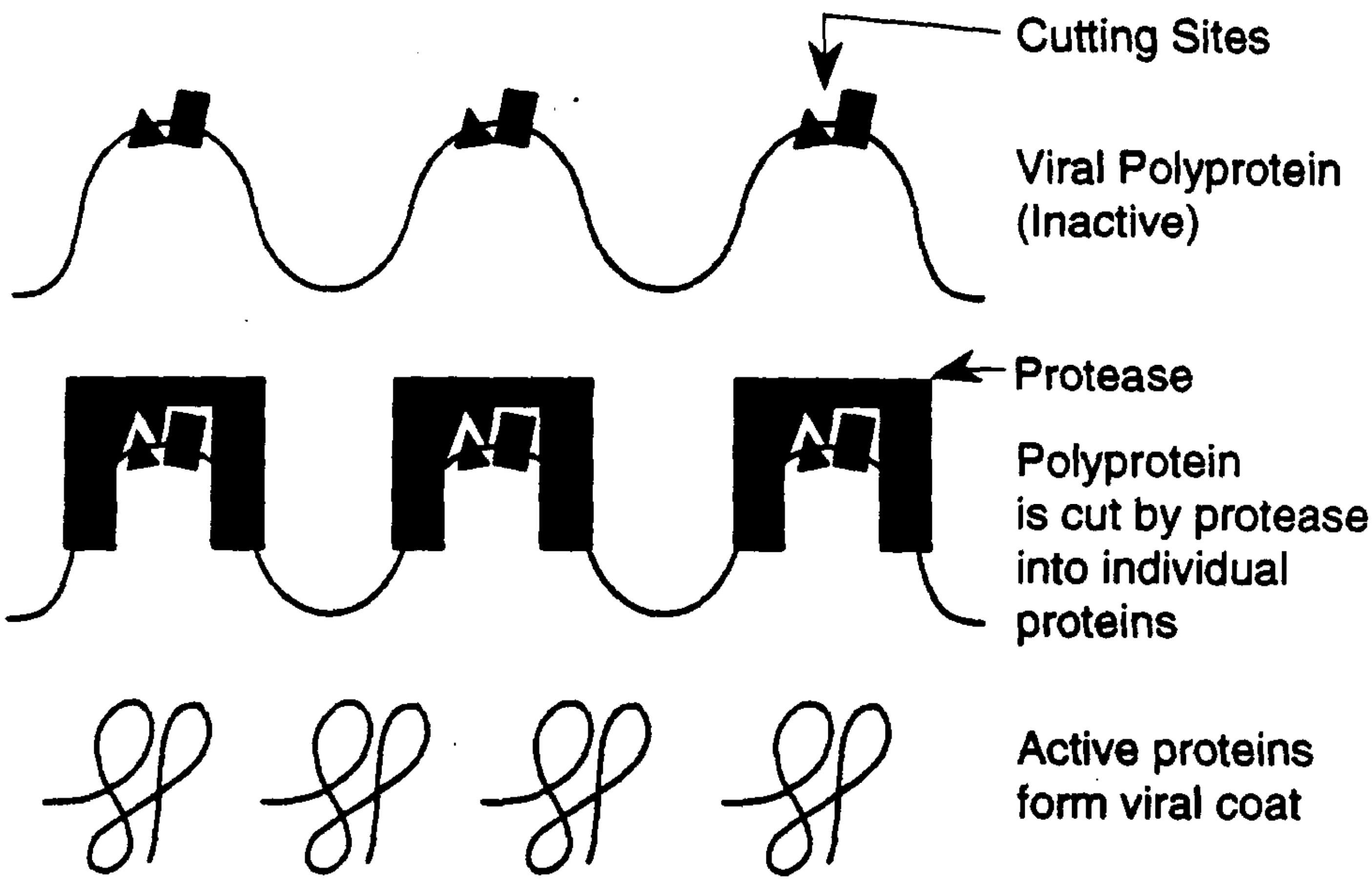
Nucleation process studied through the analysis of reflectivity transients during growth.

Demonstrated important differences between conventional, continuous growth techniques and pulsed growth techniques, such as MEE or ALE. *These differences dramatically affect the surface morphology and chemistry and thus play a role in interface abruptness and impurity incorporation.*

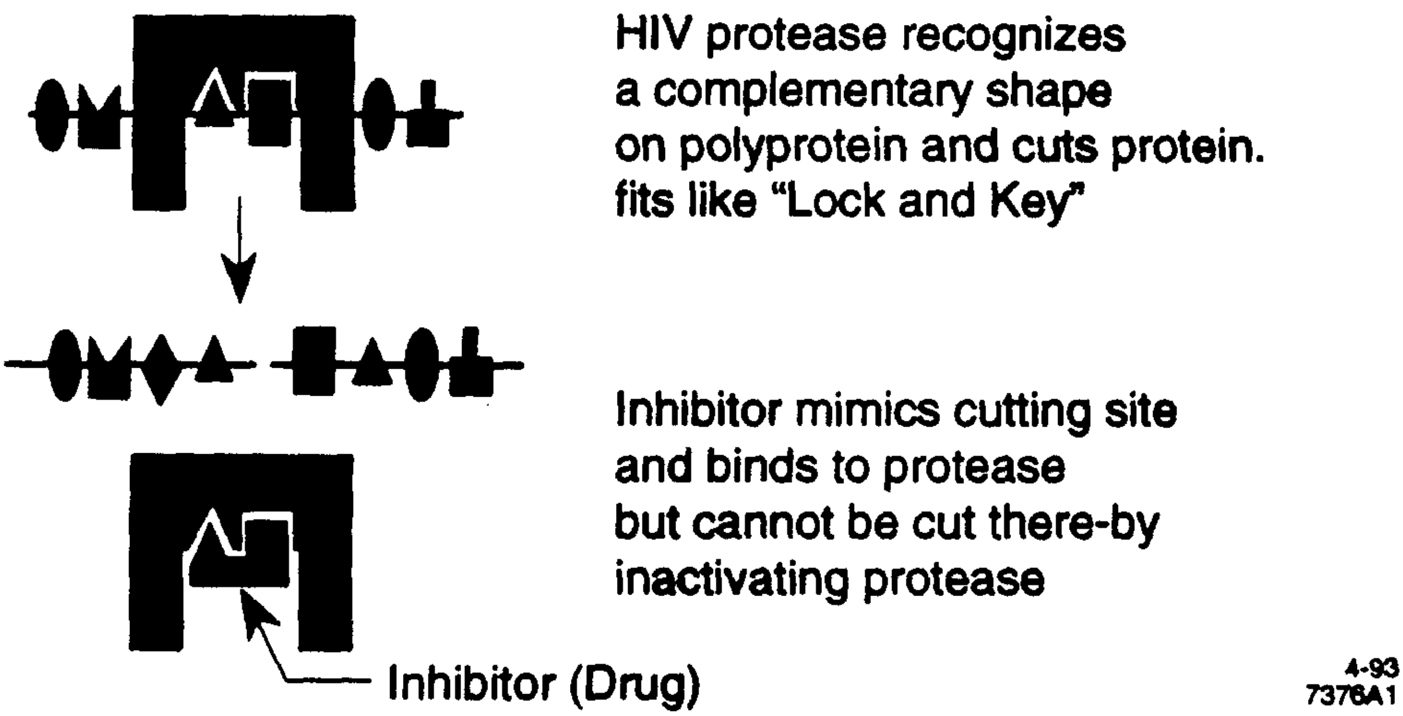
Structure of HIV protease linked to Syntex inhibitor

- **Protease critical in virus reproduction**
- **Inhibitor prevents protease from performing its function**
- **SSRL and Syntex determined structure of protease/inhibitor complex**
- **Structure shows how inhibitor works at molecular level**
- **Research aimed at helping Syntex develop even better inhibitors**

How HIV Protease Works



How HIV Protease Inhibitors Inhibit Viral Replication



SLAC is successfully pursuing its mission of fundamental science investigations in HEP and BES, but it has a very rich store of capable staff an[d] unique facilities that could be shared with interested industrial companies.

There are about a dozen good joint projects with industry under way, and the lab would like to encourage more

HEP USERS

<u>771</u>	<u>Total</u>
433	United States
338	Foreign
206	European (Cern member States)
27	Canada
16	China
46	Russia
36	Japan
7	Taiwan

STANFORD SYNCHROTRON RADIATION LABORATORY
Stanford Linear Accelerator Center
Stanford University, Stanford, CA

A NATIONAL USERS RESEARCH LABORATORY

FUNDED BY THE DOE

for utilization of synchrotron radiation for basic and applied research in medicine, the natural sciences and engineering

- o 23 EXPERIMENTAL STATIONS - 4 MORE UNDER CONSTRUCTION
- o IN 1994 560 USERS FROM 167 INSTITUTIONS PARTICIPATED IN 343 EXPERIMENTS AT SSRL
- o 54% of SSRL USERS COME from UNIVERSITIES, 10% from PRIVATE INDUSTRY, 28% from GOVERNMENT LABORATORIES and 8% FROM FOREIGN INSTITUTIONS
- o 233 ACTIVE USER EXPERIMENTAL PROPOSALS FROM 177 DIFFERENT PRINCIPAL INVESTIGATORS INVOLVING 601 SCIENTISTS
- o 211 PH.D THESES FROM 27 UNIVERSITIES COMPLETED. About 190 students from 28 universities worked at SSRL annually.
- o OVER 2600 PUBLICATIONS
- o EXPERIMENTERS FROM 30 STATES AND 11 FOREIGN COUNTRIES

For Further Information Contact:

Katherine Cantwell
SSRL
MS 69 PO Box 4349
Stanford CA 94309-0210
415-926-3191
K@SLAC.Stanford.edu

Attachment 8

DuPont Transparencies

R. Guschl

Technology Transfer at DOE Dedicated Program Laboratories
Fermi National Accelerator Laboratory
October 6, 1994

TECHNOLOGY ACQUISITION
(TECHNOLOGY TRANSFER)
TOO MANY OPTIONS

- **INTRODUCTION**
  (WHO / WHAT / WHERE / WHEN / WHY)

- **A SORTING PROCESS**

- **SUCCESS STORIES**
  (BARRIERS / SOLUTIONS)

- **THE FUTURE**

Randolph J. Guschl
Director, Corporate Technology Transfer
DuPont Company
Experimental Station, Building 326, Room 220
Routes 141 & Henry Clay Road
Wilmington, DE 19880-0326
Telephone: (302) 695-3654
Fax: (302) 695-9840

WHO (DUPONT)

- TECH TRANSFER GROUP / NETWORK OF "40"
  * Virtual Transfer Group

- CORPORATE TECHNOLOGY COUNCIL
  * 30 R&D Directors

- SCIENTISTS / ENGINEERS

- BUSINESS LEADERS

NY 5/24

WHO?
"A CORPORATE FOCUS"

- **NO ONE PLACE TO COME TO IN DUPONT**
  - 800 Number
  - Mail
  - Meetings
  - Window to DuPont
- **CORPORATE PERSPECTIVE VS. MANY UNCOORDINATED EFFORTS**
  - Strategic Plan / Direction
  - Much activity low yield
- **WELL NETWORKED; WORK FOR COUNCIL**
- **SELECTIVE TRAVEL, SPEECHES, TESTIMONY**
  - Our presence creates activity, anxiety
  - Government needs one voice
- **COMMUNICATE, LEARN FROM SUCCESS**
- **"HITS"**

NY 5/24

CORPORATE TECHNOLOGY TRANSFER

MISSION

STRATEGIC: IDENTIFY AND ACQUIRE THE TECHNOLOGIES NEEDED TO ACHIEVE THE STRATEGIC INTENT OF THE BUSINESS OF DUPONT; LICENSE / SELL UNDERUTILIZED RESOURCES.

TACTICAL:

- TECHNOLOGY ACQUISITION
  - Network with SBU's/CS&E to identify and prioritize needs.
  - Develop external networks:
    * *Technology Transfer Organizations*
    * *Government Laboratories & Agencies*
    * *Small Business Innovation Research Programs*
    * *Academic Sources*
  - Identify external research placement options in areas of interest.
  - Screen outside offers.

- FOCUS EFFORT TO BRING KEY TECHNOLOGIES INTO DUPONT.
  - Work with business and technical leadership.
  - Identify & focus on external centers of competence in key areas.

NY 5/24

WHY DO IT?

- ACCESS TO TECHNOLOGY, FACILITIES AND BRAINPOWER

- LOWER COSTS

- SPEED DEVELOPMENTS

- LOWER RISK

NY 5/24

WHY DO IT NOW?

- **LAST 50 YEARS INTERNALLY FOCUSED**
  (Houndshell Book)

- **CAN'T AFFORD ALL THOSE EXPERTS !**

- **CORPORATE EXPERTISE ON PAR WITH EXPERTS IN EXTERNAL WORLD (NO MONOPOLIES !)**

- **EXTERNAL TECHNOLOGY SOURCES REMOVING BARRIERS**
  - Key Contacts
  - Effort to Pursue Leads
  - Survival !
  - Underutilized Technologies as Assets !

NY 5/24

WHERE?
(EXTERNAL SOURCES OF TECHNOLOGY)

- UNIVERSITIES

- GOVERNMENT LABORATORIES

- OTHER COMPANIES

NY 5/24

UNIVERSITIES

- MANY SUCCESSES; BUILD ON THESE

- SHIFT IN SUPPORT
  - New Knowledge
  - Consulting / Licensing / Applied Research
  - Coordinated Effort / Database
  - Use of Specialized Facilities

- PARTNERSHIP / RELATIONSHIP / CONTRACT

- KEY IS SCIENTIST/SCIENTIST INTERACTIONS

- LOOKING FOR MULTIFUNCTIONAL OPPORTUNITIES

NY 5/24

UNIVERSITIES - BARRIERS

- INTELLECTUAL PROPERTY RIGHTS
- SECURITY
- RESPONSIVENESS
- COSTS
- TERMINATION TRAUMA

NY 5/24

GOVERNMENT LABS

- OVER 700 LABS TO PICK FROM !
- 26 CRADAS; SUCCESSES WITH FACILITIES / PEOPLE
  - Unique Knowledge
  - Brainpower
  - DuPont Personnel Placements in Labs
- GOOD CONTACTS, EASY TO FIND
- ONE VOICE FROM DUPONT
  - Focused Attendance
  - Focus on Key Funding Sources and Limitations

NY 5/24

GOVERNMENT LABS - BARRIERS

- INTELLECTUAL PROPERTY RIGHTS
- RIGHT-TO-KNOW LAWS
- MUST BE PART OF THE PROCESS
- KNOW WHAT YOU WANT
- CONSEQUENCES OF RESTRUCTURING UNCLEAR
- PRODUCT DEVELOPMENT SKILLS??

NY 5/24

OTHER COMPANIES

- SIGNIFICANTLY INCREASING
- JOINT VENTURES
- COMPANY PARTNERSHIPS
- COMPANY TECHNOLOGY AND BUSINESS EXCHANGES
- NON-COMPETITIVE RESEARCH PARTNERSHIPS
- R *AND* D

NY 5/24

A SORTING PROCESS

- A SINGLE GRID

- A FOCUS TO THE EFFORT
  - Single Contact to Process / Network
  - Quick Decisions
  - Low Yield Process; High Energy; Costly + to Others

- THE PROCESS

- BARRIERS / SOLUTIONS

- THE VALUE OF PARTNERSHIPS / STRATEGIC ALLIANCES

NY 5/24

<u>WHAT IS DUPONT?</u>
(TODAY)

WE ARE CORE BUSINESSES,

BASED ON CORE COMPETENCIES,

LOOKING FOR GROWTH !

NY 5/24

TECHNICAL CORE COMPETENCY AREAS

√ CHEMICAL SCIENCE AND CATALYSIS

√ POLYMER SYNTHESIS AND SCIENCE

√ COATINGS

√ FIBER TECHNOLOGY

√ IMAGING APPLICATIONS

√ PLANT SCIENCE

√ PETROLEUM TECHNOLOGY

√ MANUFACTURING TECHNOLOGIES

√ MODELING AND SIMULATION

√ BIOTECHNOLOGY (EMERGING)

NY 5/24

TECHNOLOGY ACQUISITION

A SIMPLE GRID

TECHNOLOGY	New	Tech Leadership Core Comp. Experts	No.
	Known	Bus / Tech Leadership	Tech Leadership Core Com. Experts
		Known	New
		MARKETS	

TECHNOLOGY ACQUISITION
A SORTING PROCESS

1. ARE WE INTERESTED (GRID)? Y / N

2. IS THERE A CONNECTION TO A CORE COMPETENCY AND/OR BUSINESS NEED? Y / N

3. FORWARD TO CORE COMPETENCY NETWORK.
   - E-mail abstract
   - By request, full package

4. SCIENTIST / SCIENTIST FOLLOW-UP.

5. OPTION WORTH PURSUING
   - Honest assessment versus many others.
   - Another option?
   - Negotiate terms.
     - Best not always lowest cost.
     - Partnerships help !
     - Legal works for business.
     - All barriers can be managed.

6. ACTUAL TECHNOLOGY TRANSFER / DEVELOPMENT
   - Maintain relationship
   - Accountability / Documentation
   - Corporate memory

7. SHARE IN SUCCESS

8. TURNING POINT: "OUR TECHNOLOGY IS NOT FULLY UTILIZED"
   - SBU pursues license
   - Corporate Technology Transfer Group
   - Outside vendor
   - Abandon

NY 5/24

SUCCESSES

- AG PRODUCTS LEADS
- NEW REFRIGERANTS
- CATALYTIC PROCESSES
- MED PRODUCTS
- POLYMER TECHNOLOGY

NY 5/24

CRITICAL SUCCESS FACTORS

- DEDICATED PERSONNEL TO:
  - Help Develop Partnerships
  - Give Consistent External Presence
  - Coordinate Internally
  - Develop Implementation Skills

NY 5/24

CRITICAL SUCCESS FACTORS (cont)

- UNDERSTAND WHAT YOU ARE WILLING TO TAKE OUTSIDE.

- IDENTIFY SOURCES OF POTENTIAL HELP.

- ESTABLISH COLLEAGUE TO COLLEAGUE RELATIONSHIPS AS FAST AS POSSIBLE.

NY 5/24

OTHER SUCCESS FACTORS

- CHANGE YOUR OWN CULTURE

- STRIVE FOR SPEEDY RESULTS TO ESTABLISH CREDIBILITY WITH INTERNAL ORGANIZATIONS

- HELP UNIVERSITY AND GOVERNMENT LABS TO FOCUS ON THEIR TRUE COMPETENCIES

NY 5/24

BARRIERS

- TOO MANY OPTIONS
  - Need Focus
  - Need Good Screening
  - Need Coordination (Network)

- NIH
  - Technical People
  - Business Management

- INTELLECTUAL PROPERTY ISSUES
  (Perceived problems)

- WINDOW TO DUPONT (Easy to Find)

- MAINTAINING A RELATIONSHIP WITH THE OUTSIDE !

- INEXPERIENCE
  - Negotiate Terms
  - Finding right partners, evaluating
  - Reluctance to reveal real need, strategy

NY 5/24

THE FUTURE

- **VISION**
  - External / Internal
  - Platforms
  - Core Competencies

- **ROLES**
  - R&D Directors
  - Professionals
  - Tech Transfer Personnel

- **WHERE WILL NEW PRODUCTS COME FROM?**
  - Cross over several core competencies
  - Shared platform Development
  - Internal where appropriate

NY 5/24

EXTERNAL TECHNOLOGIES
GENERAL PRINCIPLES

- Strategically partner with a limited number of well-established organizations which complement our internal technology base.

- For specific, well-defined technology needs, broadly solicit for bids; reward those who deliver good results.

- To maintain a win-win relationship, provide necessary funding and personnel to stay close to developments.

- Expect technology providers to be sensitive to our technology and business needs.

- Know what you want.

- Be ready to dispose of (sell?) technologies you no longer need.

- Legal, communication, etc., issues can be managed in today's world, once you find the right match-up.

- Consortia / Alliances / Industry Partnerships, etc., tend not be effective unless there is a specific business need and a steering group which own the problem.

NY 5/24

CHANGING ROLE OF SENIOR PROFESSIONALS

(TO MAINTAIN EXTERNAL RELATIONSHIP)

- **SCIENTIST / SCIENTIST TEAMS**
  - Prepare Proposal
  - Share Common Interest
  - Get Along !

- **DUPONT SCIENTIST VS. RESEARCH MANAGER**
  - More Than Hands
  - Accountable for External Accountability
  - Find "Best" vs. First
  - Frequent Communication

- **EMPOWERED**
  - Knowledge of Business Need

NY 5/24

DUPONT ORGANIZATION FOR EXTERNAL LEVERAGING

Dr. Randolph J. Guschl
Director, Corporate Technology Transfer

Dr. Alfred A. Brizzolara
Manager, Technology Acquisition

Dr. Robert R. Gruetzmacher
Manager, Intellectual Property

Dr. Heinz J. Hefter
Director, European Technology Office

Dr. Aaron C. Su
Director, Greater China Technology Office

Dr. Ashok K. Dhingra
Director, Corporate India Technology Office

Dr. F. Peter Boettcher
Manager, External Technology (Universities)

Dr. James E. Nottke
New Technology Development

NY 5/24

Attachment 9

Ford Motor Co. Transparencies

J. Anderson

Technology Transfer at DOE Dedicated Program Laboratories
Fermi National Accelerator Laboratory
October 6, 1994

UNANSWERED QUESTIONS:

- BENEFIT METRIC FOR NATIONAL LAB TECHNOLOGY. RATE ON A [1- 10] SCALE.
- OPTIMIUM FRL CRADA PORTFOLIO -- TECHNOLOGY BALANCE, # OF CRADAs.
- GM 'IN-KIND' CONTRIBUTIONS -- WHERE WILL THEY COME FROM?

Ford

James E. Anderson, Ph.D.

Advisor-Cooperative
Technology Programs
Research Staff
E-mail: janderson@smail.srl.ford.com

Scientific Research Lab
P.O. Box 2053, MD-3083
Dearborn, MI 48121
Telephone: 313/594-1187
Fax: 313/594-2923

Assumes $1 75 K/yr = 1 (USCAR) FTE
50-50 Resource Match

USCAR Headcount (FTE/yr)	USCAR Equiv. ($ MM)	Natl. Lab. Equiv. ($ MM)	Total Program ($ MM)
3	0.53	0.53	1 .1
30	5.25	5.25	1 0.5
300	52.50	52.50	1 05.0
3000	525.00	525.00	1 050.0
30000	5250.00	5250.00	1 0500.0

CRADAs IN THE

U.S. AUTOMOBILE

INDUSTRY

Statistics on Executed DOE CRADAs with the U.S. Automobile Industry

- Number of CRADAs: 59
- Total funding: $ 216 MM
- Breakdown:

	# CRADAs	Total Program [$ MM]
GM-alone	35	128.9
Ford-alone	2	3.7
Chrysler-alone	1	6.0
PNGV	15	43.7
USABC	7	34.2

Ford-Only CRADAs

- *Mesh Generation Software* - SNL
- *Sheet Forming of Aluminum* - LLNL
- *Ceramics Machining Consortium* - NIST

PNGV CRADAs

- *High Performance Computing* - (Four DOE Labs) - SCAAP
- *Reduction of NOx Emissions* - (Four DOE Labs) - LEP
- *Process Control for Laser Beam Welding* - ANL - LEP
- *Intelligent Welding for Thin Metal Sections* - INEL - LEP
- *Adhesive Bonding of Composites* - ORNL - AMP

- *Alternative Catalyst Systems* - PNL - LEP
- *Exhaust Hydrocarbon Trap* - LANL - LEP
- *Superplastic Forming of Stainless Steel* - PNL - LEP
- *Spray Formed Tooling for Automotive Components* - INEL - LEP
- *Fuel Combustion System Optimization* - LANL- LEP

USABC CRADAs

- *Advanced Electric Vehicle Battery Development* - SNL
- *Advanced Battery R&D for Electric Vehicles* - INEL
- *Battery Testing & Evaluation* - ANL
- *Lithium/Metal Sulfide Battery Research* - ANL

USABC CRADAs (continued)

- *Dynamic Thermal Enclosure for Advanced Batteries* - NREL

- *Lithium/Polymer-Electrolyte Batteries R&D* - LBL

- *Variable Conductance Insulation for SAFT Battery* - NREL

UNANSWERED QUESTIONS

- **PROJECTED BENEFIT METRIC FOR EXISTING NATIONAL LAB TECHNOLOGY. RATE ON [1- 10] SCALE. WHEN DO WE SIGN UP?**
- **OPTIMIUM CRADA PORTFOLIO:**
  - **TECHNOLOGY BALANCE**
  - **NUMBER OF CRADAs**
  - **INTERNAL vs. CONSORTIA CRADAs**
- **CRADAs AND INTERNAL CUSTOMER FOCUS**
  - **COMPETITION vs PARTNERSHIP WITH THE LABS**
  - **PROPRIETARY ISSUES**
- **UNCERTAINTY OF CRADA APPROVAL**
- **THOSE GM-ONLY CRADAS**

A FUNDAMENTAL ASYMMETRY

- **CRADAs BRING $$$ TO NATIONAL LABS**
- **CRADAs BRING NEW TECHNOLOGY TO INDUSTRY**

HOW MANY CRADAs SHOULD A NATIONAL LAB SIGN?

HOW MANY CRADAs SHOULD AN INDUSTRY SIGN?

PARTIAL LISTING OF

DOE CRADAs

(May, 1994)

	# CRADA	Fed. Funds ($ MM)	Ind. Funds ($ MM)
GM	42	74.0	80.3
California Energy Sponsors	19	4.4	23.6
IBM	18	21.1	30.5
United Technology	14	14.9	16.1
Textile Industry	13	6.8	19.5
AT&T-Bell Labs	10	24.0	27.3
Cray Computer	8	6.3	11.1
Motorola	8	13.0	17.2
Hewlett-Packard	8	14.9	18.5
3M	2	12.4	22.0
Ford	2	1.7	2.0
Chrysler	1	3.0	3.0

Raw Statistics

- Number of CRADAs = 704
- Total Federal Funds =

  $ 734.2 MM
- Total Industrial Funds =

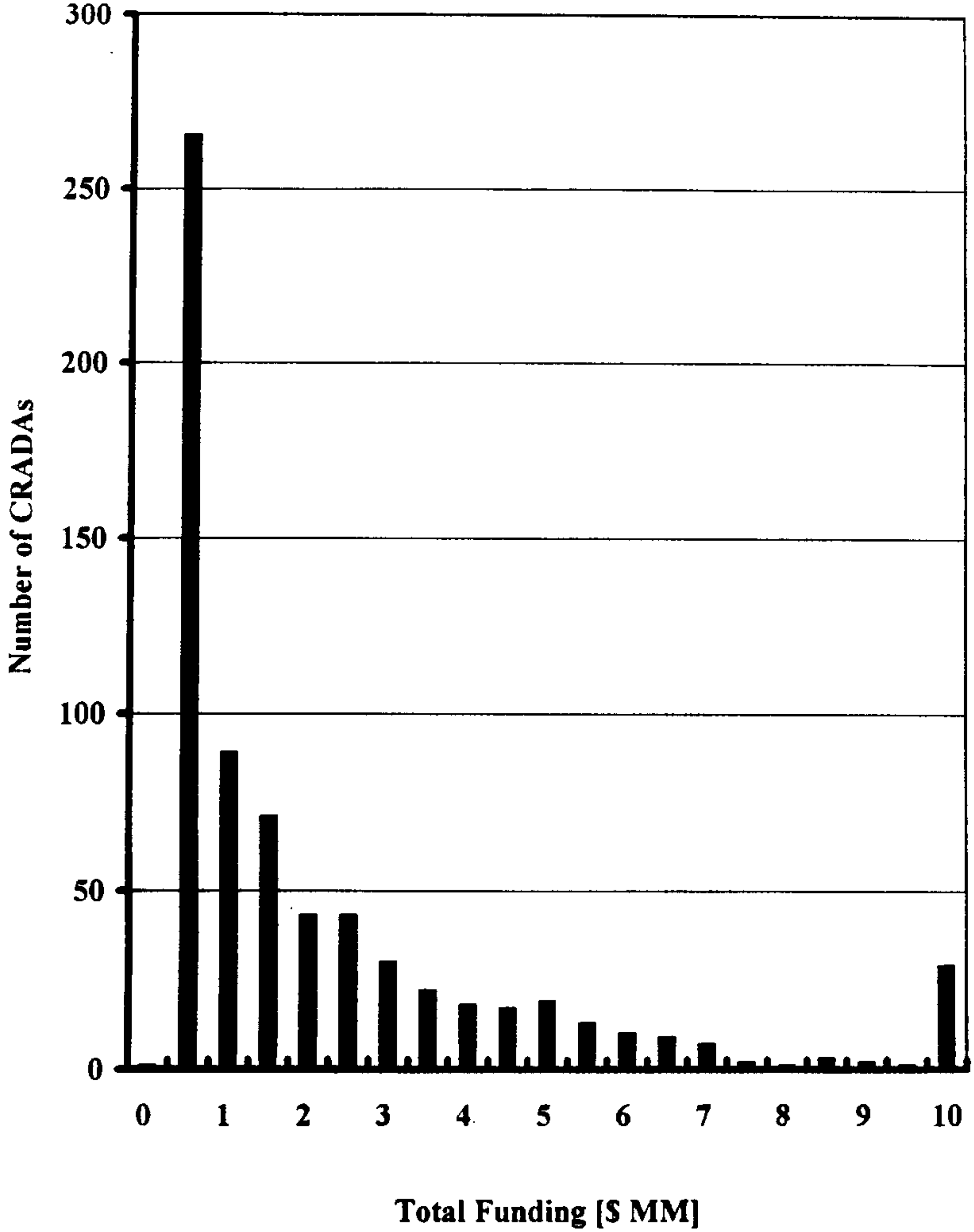
  $ 912.0 MM
- Federal Funds going to

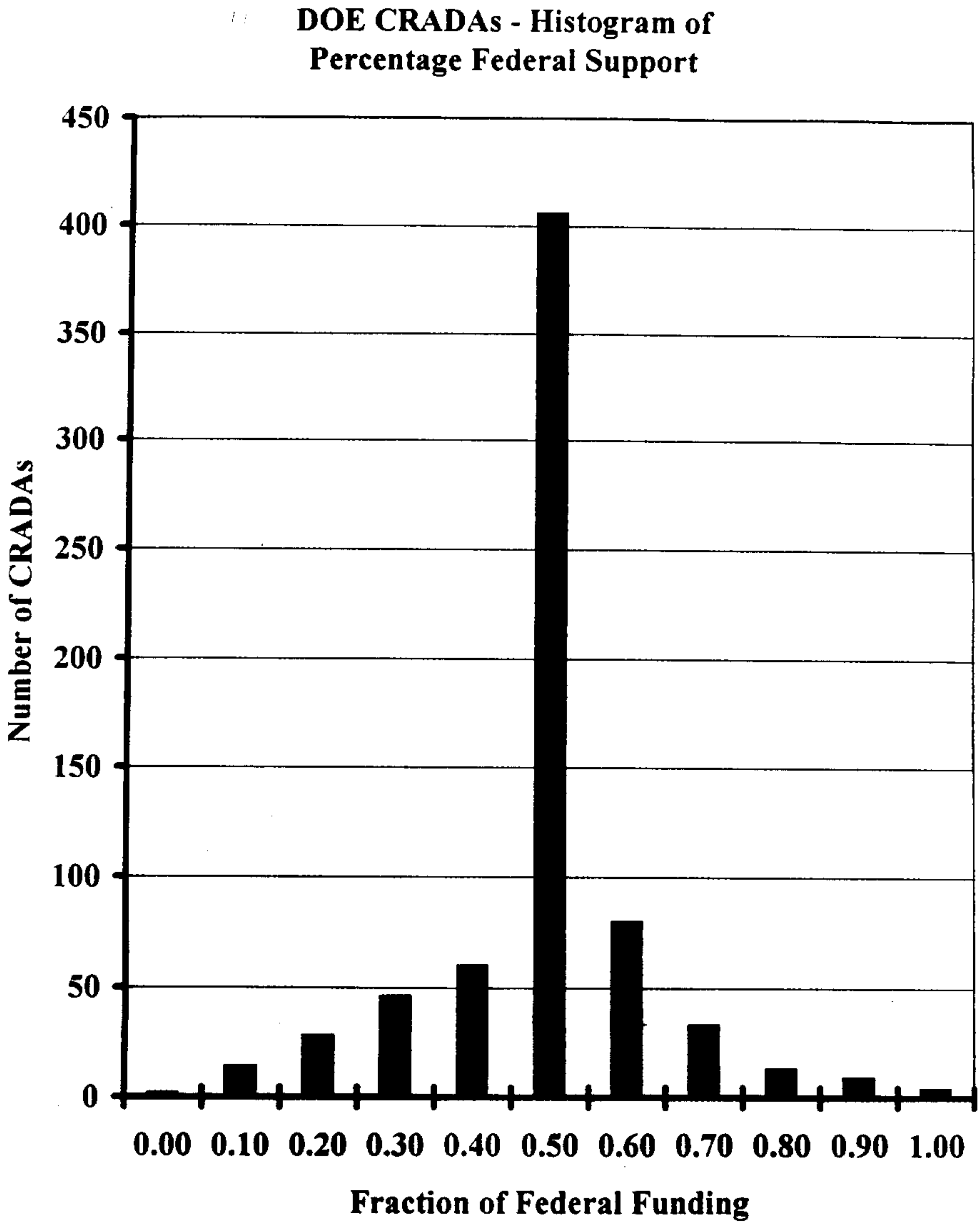
  Industry = $ 0
- FOREIGN Participation =

  22 [3.1% of the Total]
- UNIVERSITY Participation =

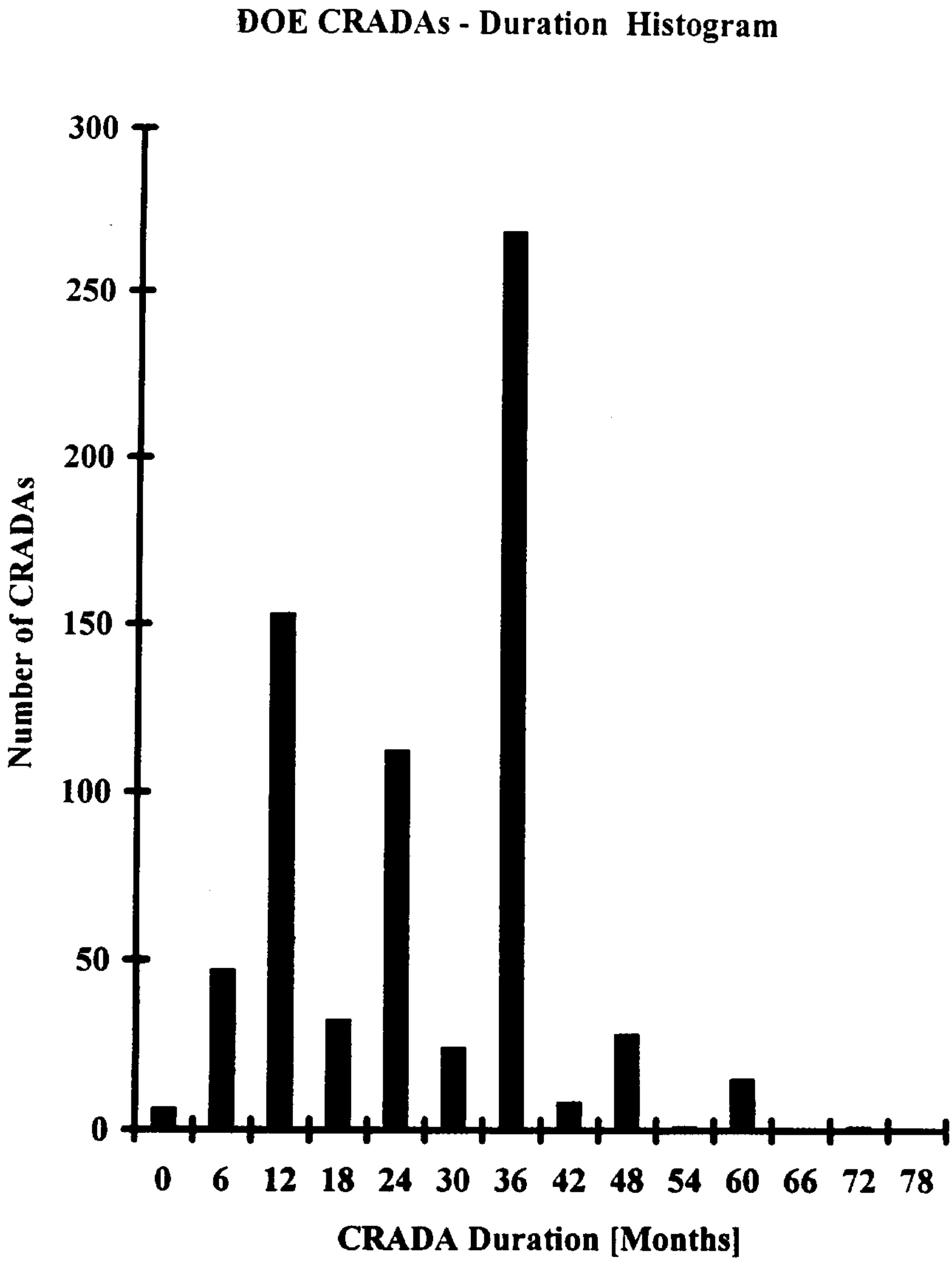
  52 [7.4 % of the Total]

DOE CRADAs - Funding Histogram





J.E. Anderson *6/7/94, 6:00 PM*



J.E. Anderson *6/7/94, 6:01 PM*

Attachment 10

Motorola
Transparencies

C. Shanley

Technology Transfer at DOE Dedicated Program Laboratories
Fermi National Accelerator Laboratory
October 6, 1994

Cooperative R&D
with the Dedicated Program Labs

- **Good for Industry...**
  - Leverage research dollars in areas of mutual interest
  - Access to specialized equipment industry does not have
  - Access to talented specialists

- **Good for the Labs...**
  - Demonstrates industrial relevance to Congress
  - Access to incremental dollars
  - Transfer of industrial orientation to the Labs

MOTOROLA Dr. Charles "Chip" Sharley

Industry Problems

- Perception that National Labs are less productive than industry labs
- Lack of allocated funding
  - "Who do I cut to fund this work?"
- "Not Invented Here" syndrome
- Inability to cut favorable deals
  - Exclusive rights?
  - Worldwide use of technology?

Three Industry "Gates"

for government cooperative research

- Legal Gate
  - The contract must be acceptable form a legal point of view
    - DOE model CRADA entirely unacceptable
    - Most problems fixed with the CSPP model CRADA
      - But this imposes limits on the research subject
- Intellectual Property Rights (IPR) gate
  - IPR must be reciprocal
  - Must have possibility of exclusive rights
  - Rights must be able to be practiced worldwide
- Federal Compliance Gate
  - Industry must have proper accounting procedures in place
    - But lab directors are loathe to sacrifice productivity

MOTOROLA

What Industry Wants

- **Realistic legal terms**
  - Liability
  - Protection of proprietary information
  - Pre-publicaton rights
  - Records and Accounting
- **Right to practice derived knowledge anywhere**
  - Modify US Competitiveness clause
- **Reciprocal IPR rights / option for exclusive rights**
  - Industry gives US non-exclusive rights to Industry inventions
  - Industry expects non-exclusive rights to government inventions
  - Option for royalty bearing exclusive rights
- **Both single company and consortia agreements**

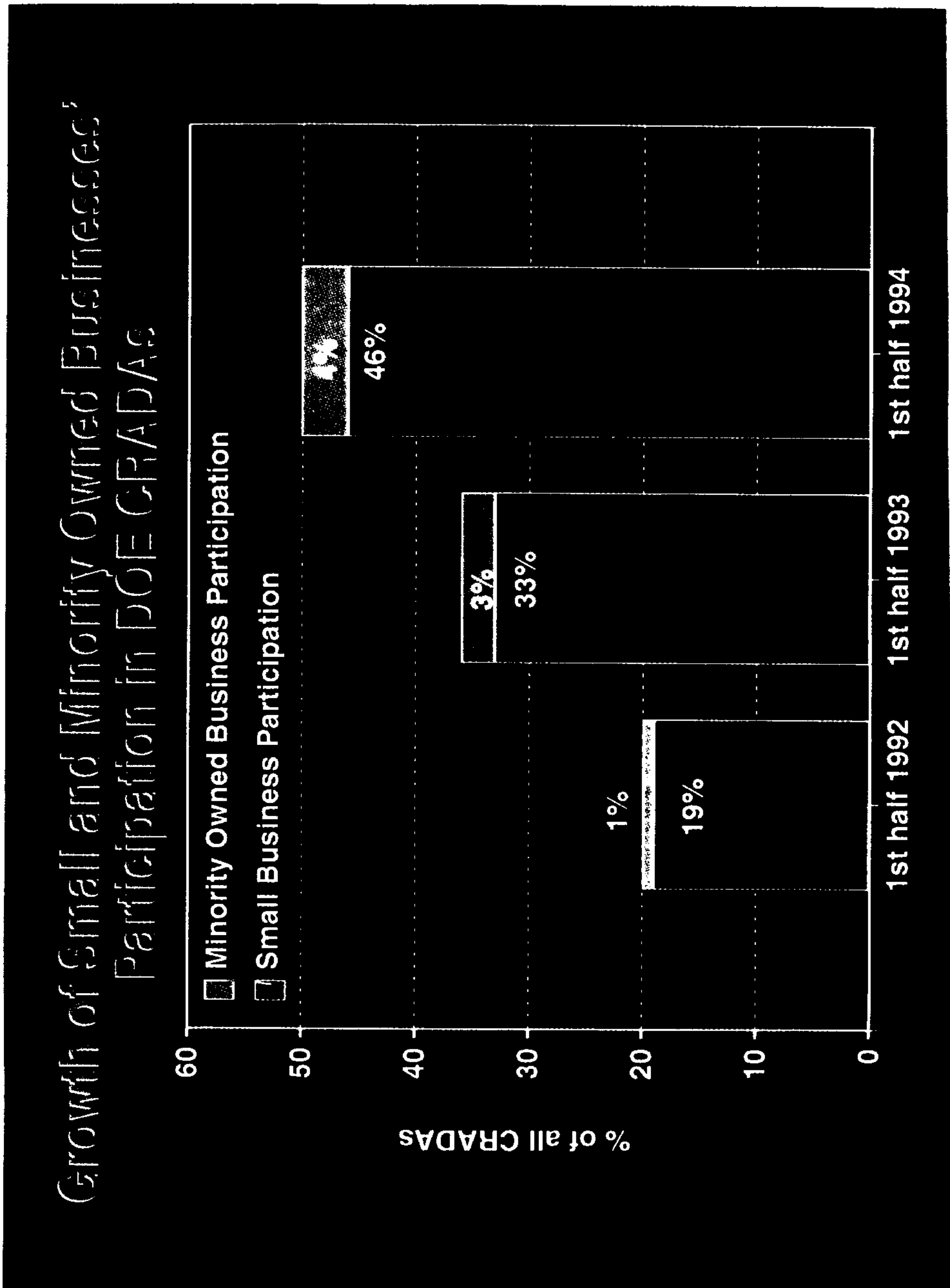
MOTOROLA

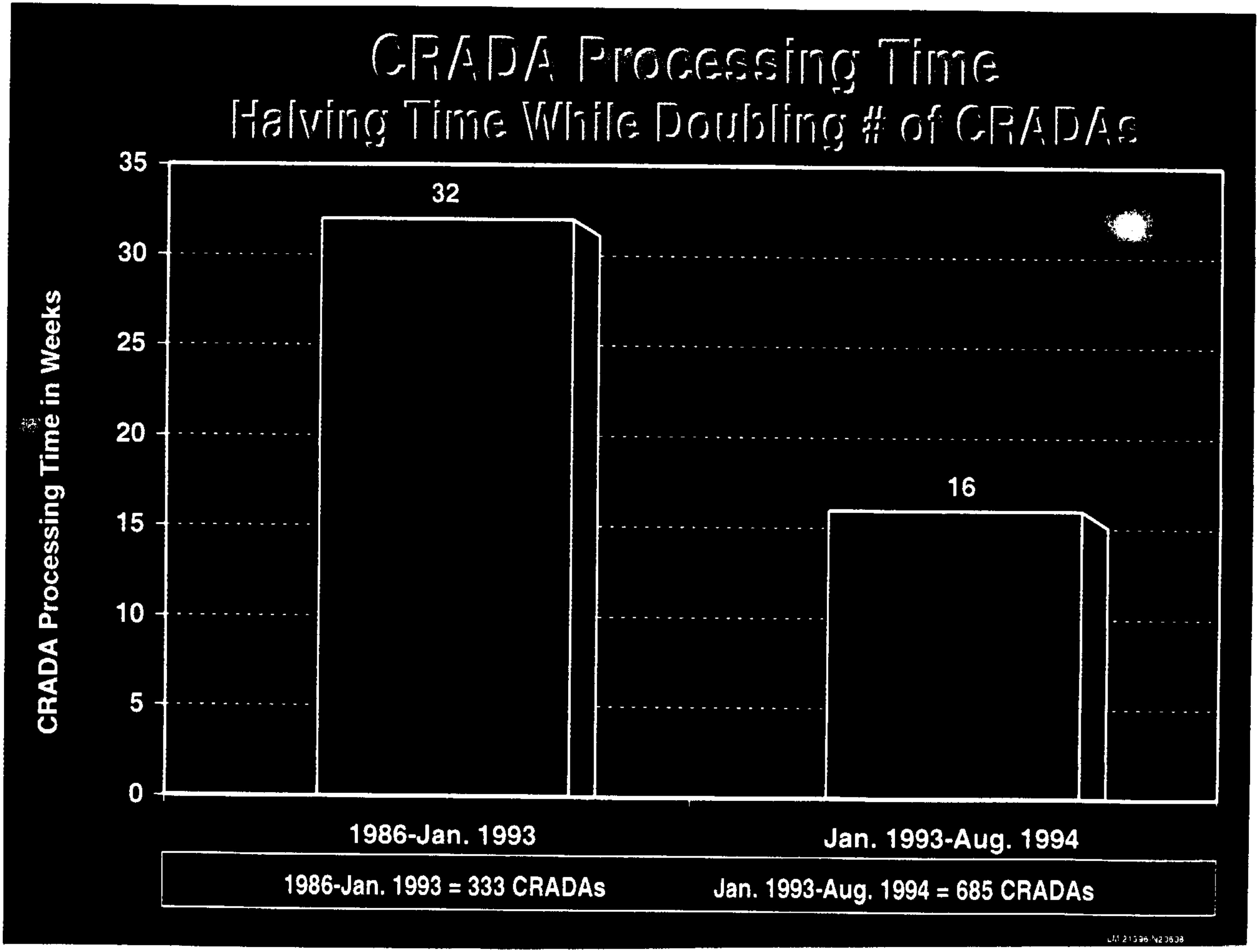
Attachment 11

DOE/HQ Transparencies

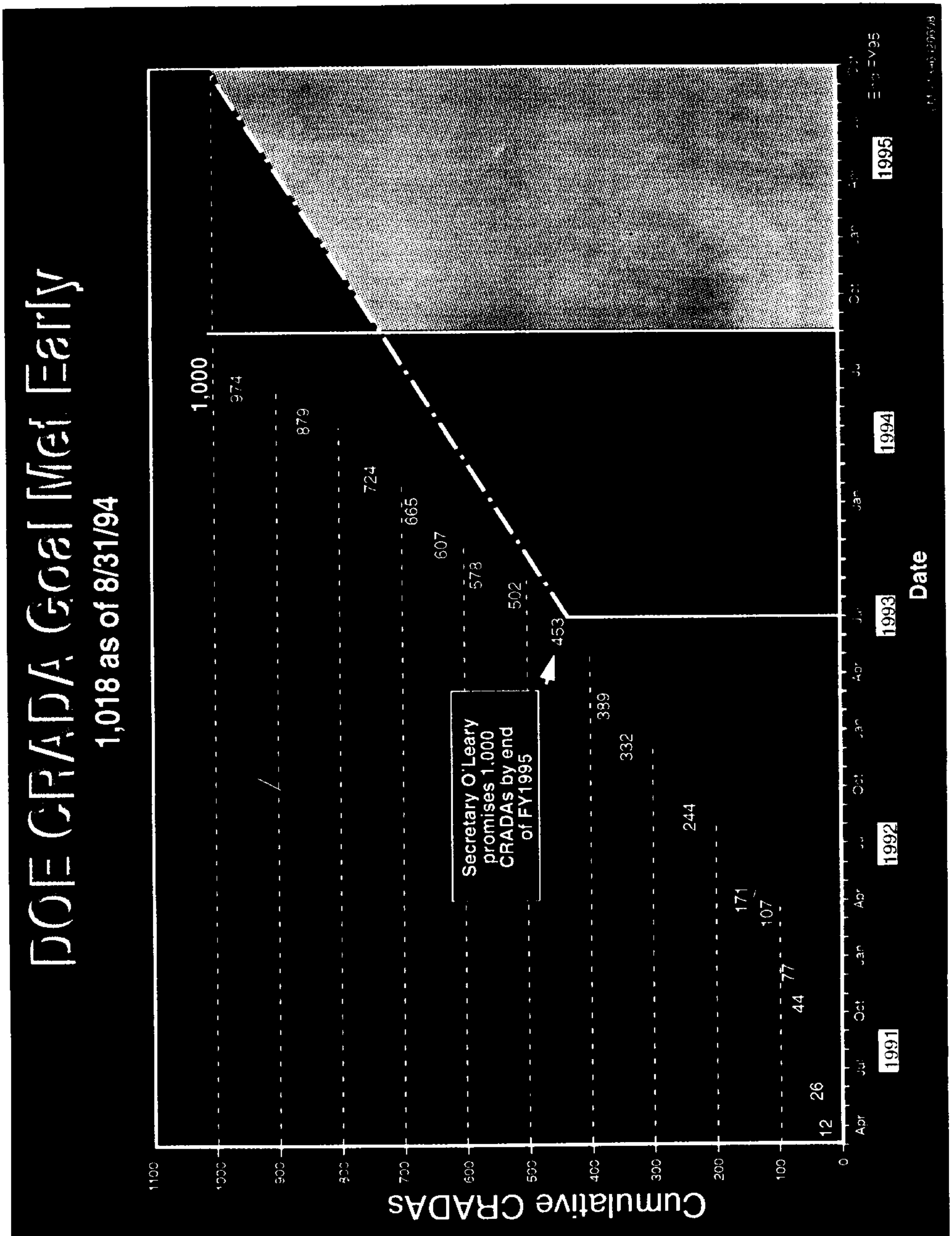
D. Cheney

Technology Transfer at DOE Dedicated Program Laboratories
Fermi National Accelerator Laboratory
October 6, 1994


Growth of Small and Minority Owned Businesses'
Participation in DOE CRADAs
Minority Owned Business Participation
Small Business Participation
% of all CRADAs
60
50
40
30
20
10
0
1%
19%
3%
33%
46%
1st half 1992
1st half 1993
1st half 1994



CRADA Processing Time
Halving Time While Doubling # of CRADAs
CRADA Processing Time in Weeks
35
30
25
20
15
10
5
0
32
16
1986-Jan. 1993
Jan. 1993-Aug. 1994
1986-Jan. 1993 = 333 CRADAs
Jan. 1993-Aug. 1994 = 685 CRADAs


DOE CRADA Goal Met Early
1,018 as of 8/31/94
Cumulative CRADAs
Date
Secretary O'Leary promises 1,000 CRADAs by end of FY1995
1,000
12
26
44
77
107
171
244
332
389
453
502
578
607
665
724
879
974
1991
1992
1993
1994
1995

As of 8/31/94

- **There are currently 7 major multi-party partnerships with the DOE:**

Appliance Research Consortium, Inc	2
AMTEX	27
California Institute for Energy Efficiency Sponsors	22
U.S. Council for Automotive Research (USCAR; includes:)	21
Low Emissions Technology D&D Partnership	
U.S. Advanced Battery Consortium	
Environmental Research Consortium	
Vehicle Recycling Partnership	
Low Emissions Technologies R&D Partnership	
Supercomputer Automotive Applications Partnership	
U.S. Automotive Materials Partnership	
Motor Vehicle Manufacturing Association of U.S.A., Inc.	2
National Center for Manufacturing Sciences (NCMS)	8
SEMATECH	5

- **The collective value of these 87 CRADAs is over $277 million. They enjoy a 59% industry cost share, compared to the overall 56% industry share of the total 1000 CRADAs.**

- **These 7 partnerships collectively account for just under 9% of all CRADAs, and just over 14.5% of the total value of all CRADAs.**

LM.21396\K20608

Directions in DOE Technology Partnerships

	1990-1992	1993-1994	1995-1996+
Main Tasks	Establish mechanisms	Streamline Process	*Long-term Effectiveness*
Competitive-ness a DOE mission?	Not widely accepted	Accepted	*Integral to other DOE Missions*
Partnership Selection	Walk in	Ad hoc	*Based on DOE/Industry joint strategy clear criteria*
Metrics	Anecdotal	Input, e.g # of CRADAs	*Systematic: Input, Output Process, Trends*
Budget	Limited	Set-aside	*Program + Set aside*
Integration	"Stovepipes"	More consistent policies & procedures	*Integrated with Dept. & Agencies, NSTC*

Directions in DOE Technology Partnerships, continued

	1990-1992	1993-1994	1995-1996+
Engagement process	Difficult/ too long	Improved for CRADAs	*Easy for all Mechanisms*
Finding DOE Capabilities	Serendipity	Expanded Outreach	*One-stop shopping*
Portfolio	Mostly large companies	More consortia small business	*Balance of large & small + consortia*

Attachment 12

DOE/HQ Transparencies

A-M. Zerega

Technology Transfer at DOE Dedicated Program Laboratories
Fermi National Accelerator Laboratory
October 6, 1994

Energy Research Laboratory Technology Transfer Program

Program Overview

August 4, 1994

OUR MISSION:

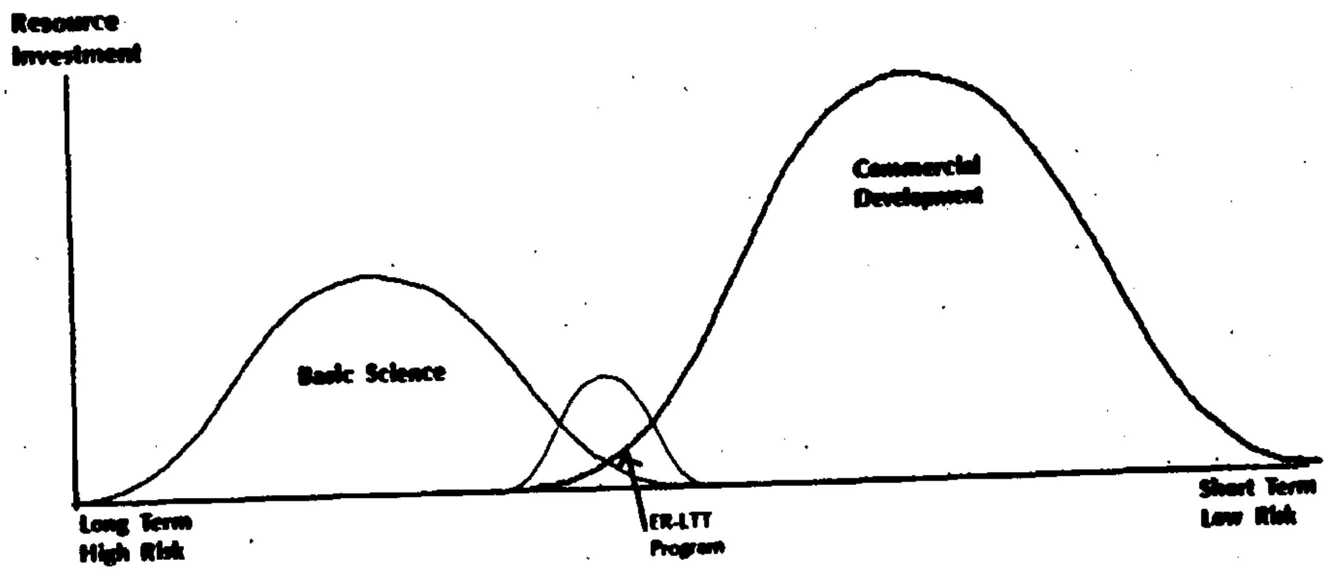
To conduct industry-driven research and development projects that link the Office of Energy Research science programs and laboratories to national economic competitiveness.

Energy Research Laboratory Technology Transfer Program

July 18, 1994
Page 2

Energy Research Laboratory Technology Transfer (ER-LTT) Program

Implements the ER Strategic goal of providing new and improved technologies that add value to the US economy by bridging the gap between basic science and commercial development.



Energy Research Laboratory Technology Transfer Program

ER-LTT Strategic Plan

Program Goals:

- Expand and strengthen industry-driven R&D partnerships at the ER laboratories, leveraging departmental expertise in critical technologies and industrial resources to maximize measurable mutual benefits.

- Provide cost-effective and responsive access to ER science and technology facilities and capabilities.

- Demonstrate relevance of ER science programs and user facilities to economic competitiveness.

Energy Research Laboratory Technology Transfer Program

July 18, 1994
Page 5

ER-LTT Strategic Plan

Program Objectives:

- Establish an industry collaboration office at each ER laboratory to provide technology focus area managers.
- Leverage program funding with other ER programs and other PSO's.
- Meet industry's needs by providing more flexibility at the laboratories in business arrangements.
- Expand small business technical assistance program.

Energy Research Laboratory Technology Transfer Program

Quality Management

ER-LTT implements the Administration's technology policies and the Department's new Core Values and vision to be...

"A recognized leader and partner with industry in developing and transferring science and technology to enhance economic performance and to serve public needs,"

... through Quality Process.

Program Organization

People

- o Technology Area Managers
- o Process Managers

Projects

- o Quick response technology deployment
- o Multi-year CRADAs
- o Major partnerships

Energy Research Laboratory Technology Transfer Program

July 18, 1994
Page 8

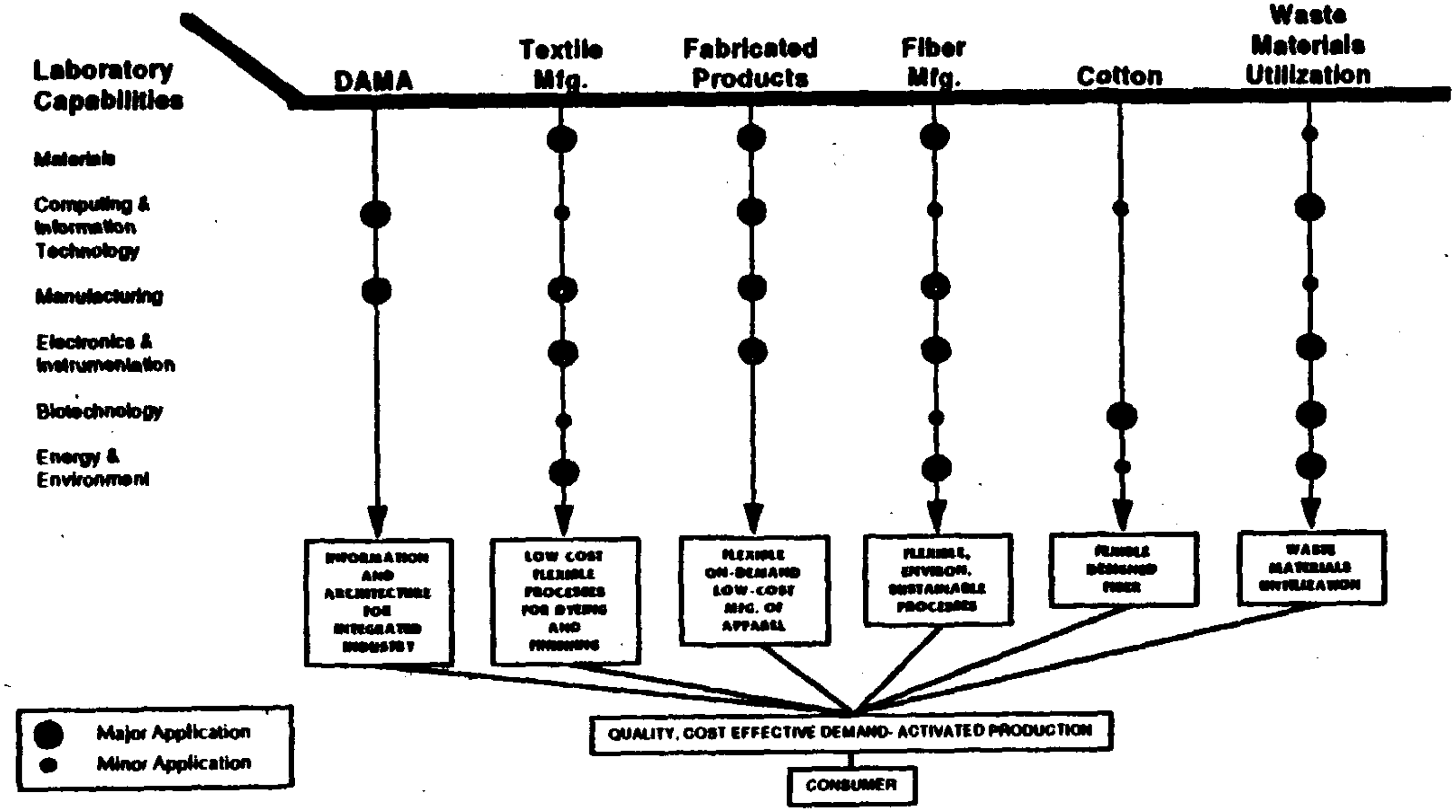
Technology Focus Areas

Critical technology areas for National economic development have been identified. Industry collaboration projects at each ER laboratory are focused in critical technology areas where the laboratory's core competencies are strongest.

	ER Multiprogram Laboratories				
Critical National Technology Needs	ANL	BNL	LBL	ORNL	PNL
Materials	Focus Area	Focus Area	Focus Area	Focus Area	
Computing	Focus Area				
Manufacturing				Focus Area	Focus Area
Electronics and Instrumentation			Focus Area		Focus Area
Biotechnology and Health		Focus Area	Focus Area		
Energy and Environment	Focus Area	Focus Area		Focus Area	Focus Area

Energy Research Laboratory Technology Transfer Program

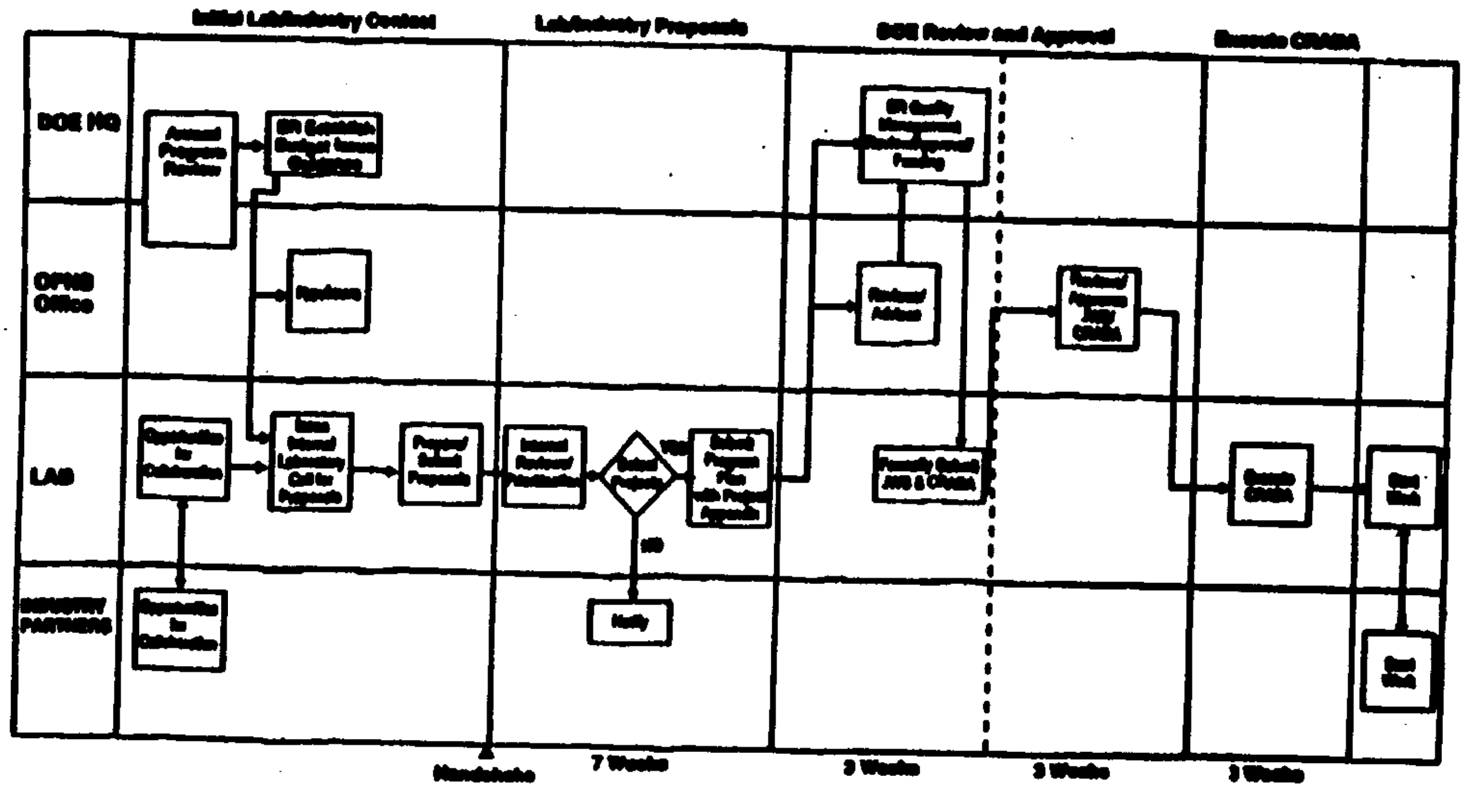
AMTEX Industry Initiatives Match DOE Laboratory Capabilities



Energy Research Laboratory Technology Transfer Program

July 14, 1994
Page 14

New Streamlined Process



Energy Research Laboratory Technology Transfer Program

Major Partnerships

	Department of Energy					Other Government Agencies					
	DP	ER	EE	FE	EM	DOD	DOC	EPA	NSF	DOT	NASA
PNGV	S	S	LD			S	LG	S	S	S	S
AMTEX	S	LD	ud			ud	ud	ud			
ACTI	S	S1		LD							
NII	S	S				S	S	S	S		S
Biomedical & Health	S	LD2				ud	ud				
Integrated Circuit	LD					LG					
EUV-Lithography	LD										
Aircraft engine advanced materials	LD	S	S			S	S		S		LG
Flat-panel displays	LD	S				LG					
Agile Manufacturing	LD	S				S	S		S		
Machine Tools	LD					ud	S		ud		

S: Supports the Partnership LD: Department Leader LG: Goverment-wide leader ud: Under Discussion
1: ER Programs involved include TT, Advanced Computing and Geosciences 2: ER programs involved include: TT, OHER
"Integrated Circuit" is Integrated Circuit Fabrication and packaging;
"EUV Lithography" is Extreme UltraViolet projection Lithography for Semiconductor Manufacture

Energy Research Laboratory Technology Transfer Program

July 18, 1994
Page 20

Major Partnerships

- o Need strategic approach - not piecemeal
- o Great growth potential - demand far exceeds budgets
- o Management intensive
- o Need technology roadmap from industry
- o Need results to maintain
- o DOE working well across PSO's
- o Interagency coordination just starting
- o Convergence by all agencies in Critical Technology Focus Areas and in Major Partnerships

Energy Research Laboratory Technology Transfer Program

Program Process

Program Budget Guidance
- o Based on performance

Laboratory Plan
- o Common Criteria
- o Merit review process
- o Industry oversight board

HQ Approval of plan

Laboratory Implementation

Technology Area/Partnership Coordination

HQ Annual Program review

Energy Research Laboratory Technology Transfer Program

Program Evaluation

- Survey of 77 Personnel Exchanges
  - 31 new processes or products
  - 28 follow-on CRADAs
  - 26 patent disclosures
  - 2 copyrights
  - 296 jobs created or retained
- Questions for CRADA partners
  - Satisfaction?
  - New/improved products/processes?
  - Jobs?
- Active in Departmental Evaluation Work Group
  - 14 page survey instrument

Accomplishments

Selected and supported to date (FY 92 - 94) over 100 multi-year CRADAs, 50 single-year CRADAs and 20 AMTEX CRADAs.

Over 35% of multi-year CRADAs have small business participation, almost double the DOE's overall average.

55% of multi-year CRADAs costs have been provided by Industry partner.

Implemented a Minority Business initiative at all ER multiprogram Laboratories, based on an Oak Ridge National Laboratory pilot project supported in FY 93, to provide targeted opportunity identification, personnel exchanges, and technical assistance.

A CRADA at BNL with Continental Optical Corp. improved the Long Trace Profiler instrument, making it the standard for measuring x-ray optics throughout the world, and resulting in a Photonics Circle of Excellence Award as one of the 25 most technically innovative optical products of 1993.

Led development of AMTEX collaboration as a model partnership for the Department; reached full agreement on terms of the Master CRADA in record time.

Energy Research Laboratory Technology Transfer Program

Accomplishments

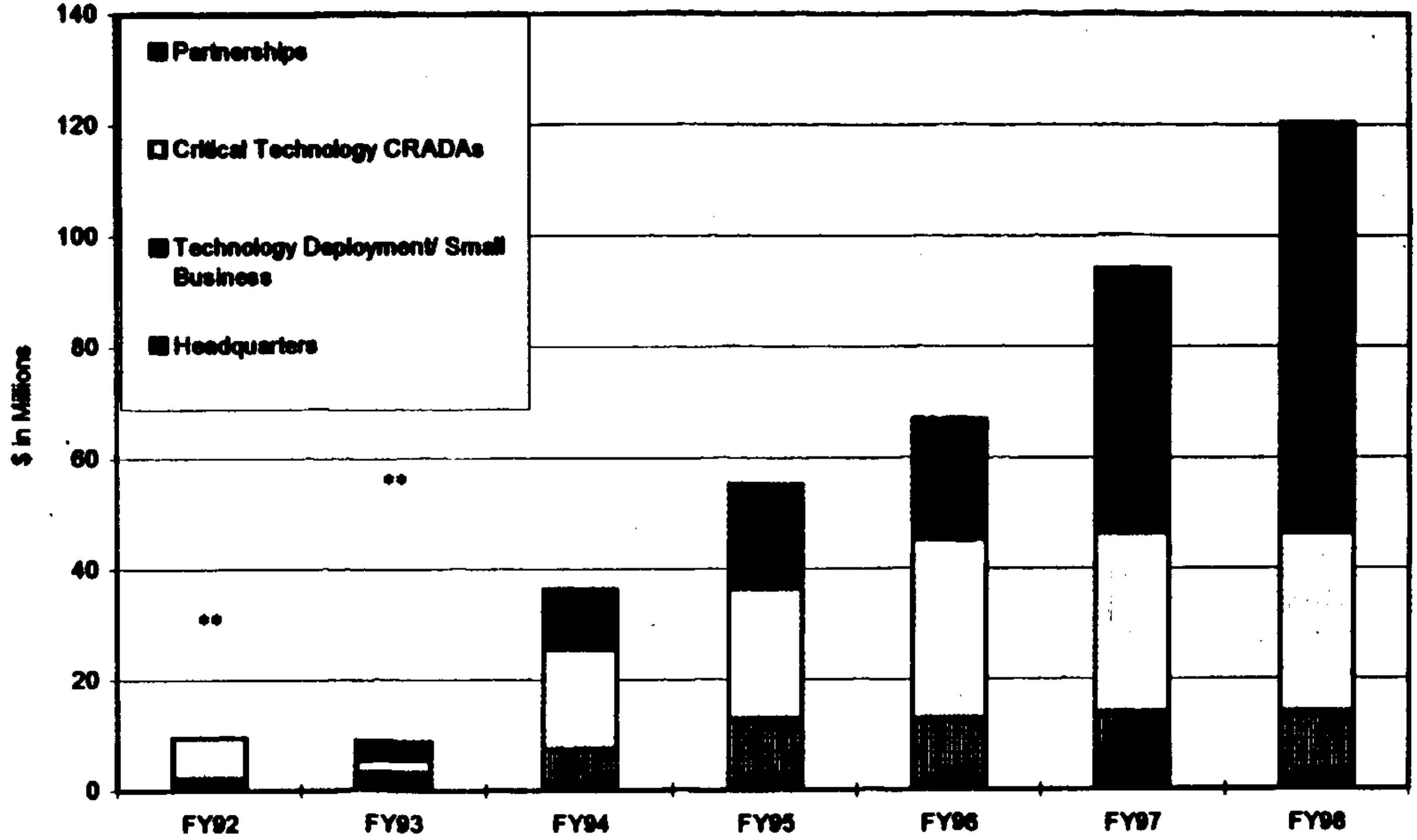
Supported 7 of the 21 initial projects of the USCAR initiative, which is led by EE.

A quick response project at ANL with Porter Engineering, a small business, developed engineering design software that ultimately led to the creation of 200 new jobs in inner-city Chicago.

A CRADA, supported by ER-BES and ER-LTT, at ORNL with Microwave Laboratories Inc. (MLI), a small business, has resulted in the development and commercialization of a variable frequency microwave oven. A steady flow of orders is anticipated for this product. Also, as a result of the research conducted under this CRADA, MLI has begun a collaborative development effort with a major chemical company to create another new product aimed at the polymer composities market.

A quick response project at PNL is enabling a new company, Viatex Recovery Systems,Inc, to commercialize a waste acid detoxification and reclamation process; the potential target market is over 15,000 companies that produce acid wastes in their daily operations.

Funding Plan



** Original Planned Funding Level

Energy Research Laboratory Technology Transfer Program

August 3, 1994
Budget Overview - Page 39

Attachment 13

DOE/CH Transparencies

C. Langenfeld

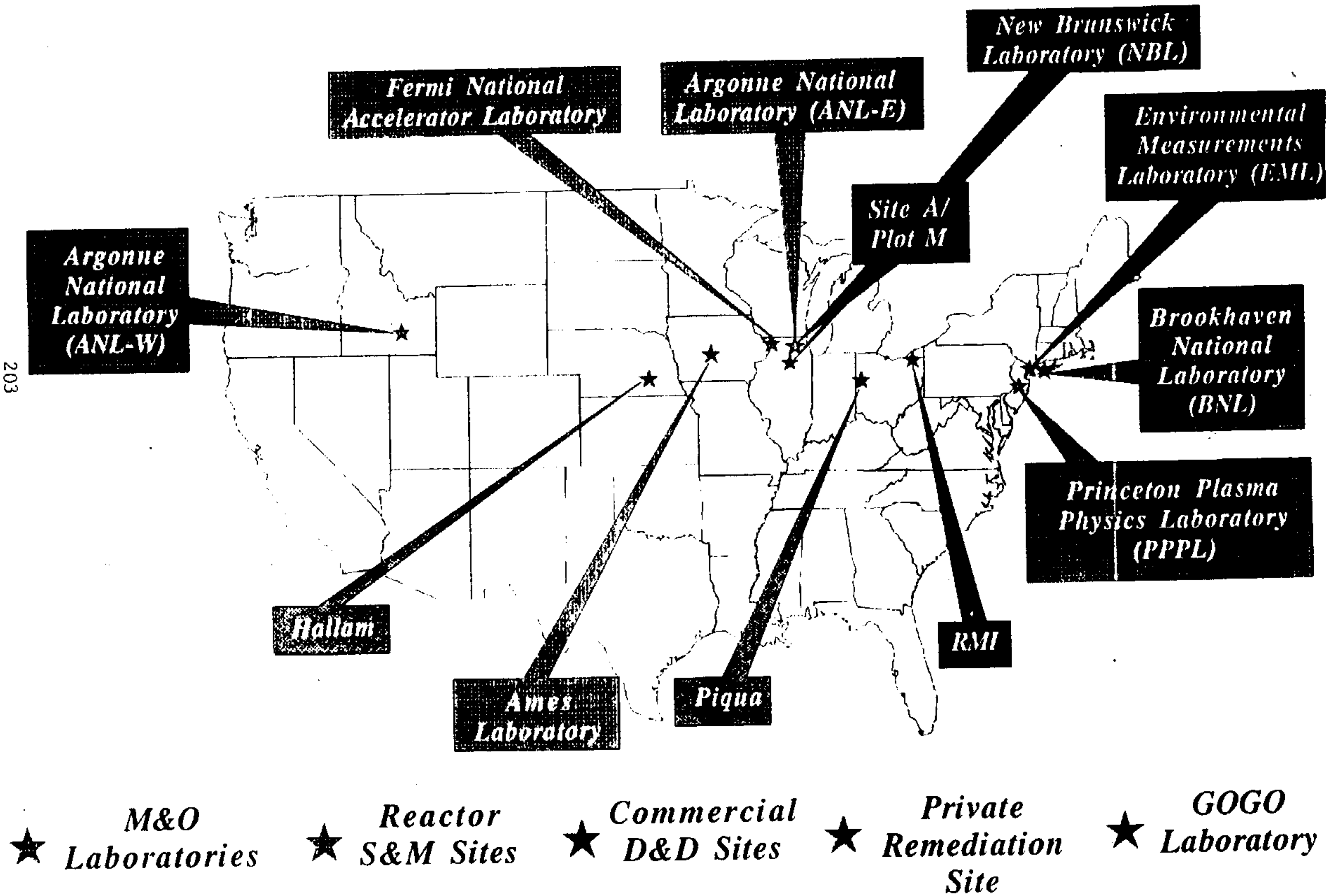
Technology Transfer at DOE Dedicated Program Laboratories
Fermi National Accelerator Laboratory
October 6, 1994

Technology Transfer
at
DOE Program Dedicated Laboratories

DOE/CH
Perspective

Cherri J. Langenfeld, Manager
DOE Chicago Operations Office
October 6, 1994

CHICAGO OPERATIONS OFFICE
Key Facilities/Projects



The Opportunity

ACCESS

COST

OWNERSHIP

BUREAUCRACY

TIME

What do we do?

Contract Management

Facilities Management

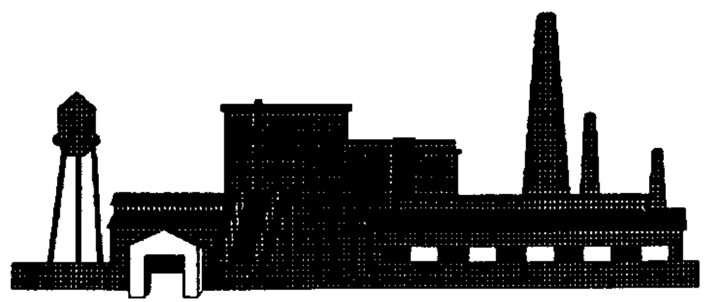
Project Management

Program Management

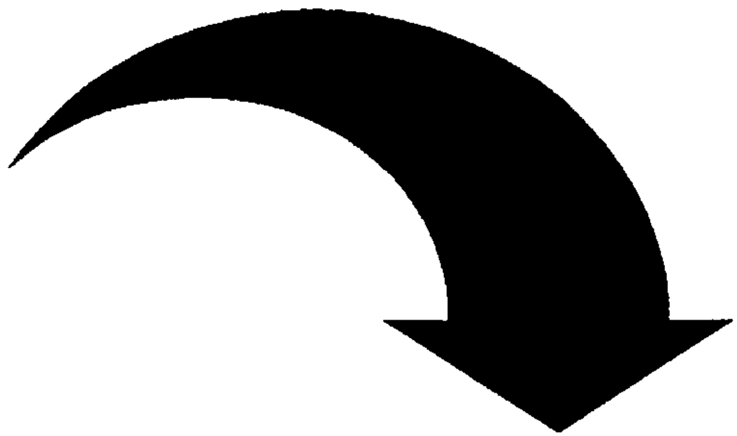
Management Support

DOE Strategic Plan

Industrial Competitiveness Business Line



Chicago Operations Office
Strategic Plan



Regional Technology
Transfer
Initiatives

Pilot Technology Transfer Initiative

Pollution Prevention/Waste Minimization

- Builds on on-going DOE/Laboratory programs and activities

- Examples
  - Partnering with EM Public Participation and Program staff
  - Networking with Energy Efficiency staff in Technology Transfer
  - ANL Educational Affairs assisting with Teacher Interchanges

- Pollution Prevention Interchanges
  - ANL -- Hazardous Waste in Laboratories
  - BNL -- Micro Chemistry in School Laboratories
  - ANL -- Inner City Recycling

- New Initiative in Development
  - Hospital Low-level Rad Waste

Industrial Partners Feedback
Improving Customer Service

- Six Conferences Nationwide
- CH Managing Two Conferences:
  - October 19, Chicago
  - October 21, New York
- Feedback From Current and Future Industrial Partners:
  - How Well Do Existing Mechanisms Meet Their Needs?
  - What Can We Do Better?
  - How Can We Measure Performance?
- DOE Seeking Partners' Ideas
  - Improvements
  - New Initiatives

Roadmap to Technology Project

East/West Corporate Corridor Assn.

- Manual for Business Groups
  - Assist in accessing DOE Laboratories

- Pilot Test of process -- Argonne
  - EWCCA Members
  - Educational Institutions

Diversity and Technology Transfer

Strenthening the DOE Lab Role

- Forming New Networks
  - Outreach Network (ON)
  - Business Assistance Network (BAN)
- Funded Chairs at Historially Black Colleges and Universities (HBCUs)
- Technology Transfer Internships
  - Faculty/Students from HBCUs

BENEFITS OF OWNERSHIP

LEARNING TO SAY YES!

BRINGING NEW PARTNERS IN

FINDING NEW FUNDING

REDUCING COSTS

NEGOTIATING "WIN-WIN-WIN-..."

WHAT DO WE BRING TO THE PARTNERSHIP?

KNOWLEDGE

CONTRACTS	PUBLIC AFFAIRS
PATENT LAW	GENERAL LAW
FINANCE	OPERATIONS
PROJECT MGT.	ETC.

EXPERIENCE

INDUSTRY	BUSINESS
GOVERNMENT	TECHNICAL

NETWORKS

- WITHIN DOE
- OTHER LOCAL AGENCIES
- UNIVERSITIES
- REGIONAL BUSINESS NETWORKS